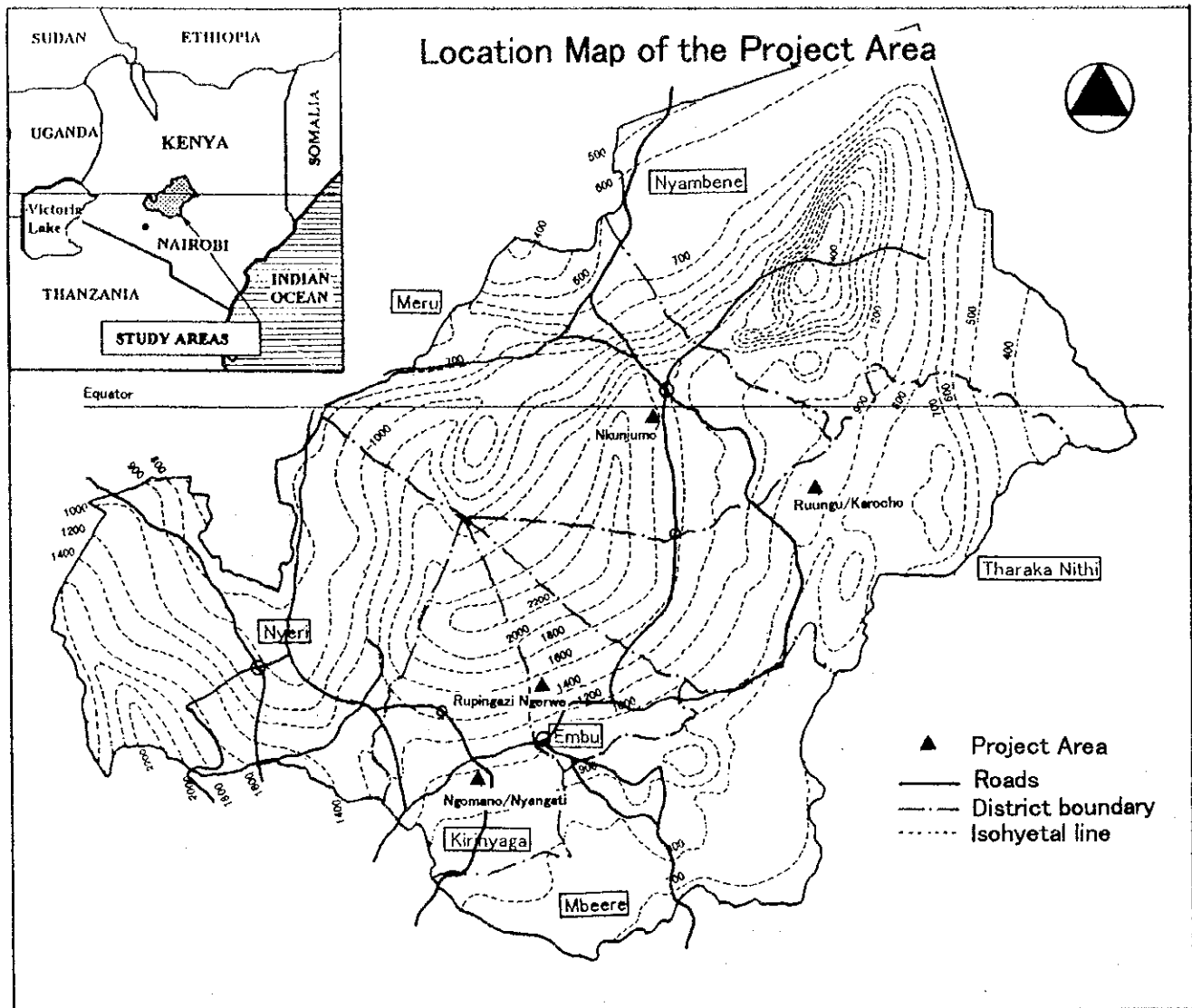
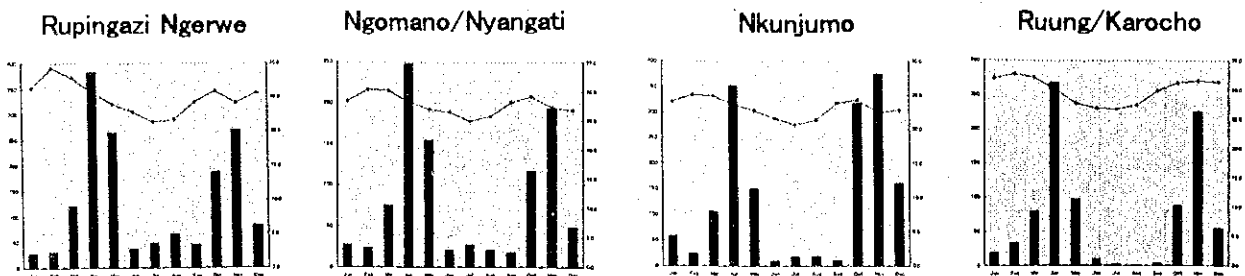


FEASIBILITY STUDY



Monthly Rainfall and Mean temperature



	Rupingazi Ngerwe	Ngomano/Nyangati	Nkunjumo	Ruung/Karocho
1. Province	Eastern	Central	Eastern	Eastern
2. District	Embu	Kirinyaga	Meru	Tharaka Nithi
3. Annual rainfall(mm)	1,364	1,014	1,259	847
4. Total area(ha)	166	376	160	NA
5. Elevation(m)	1,600	1,200	1,600	750
6. Present irrigable area(ha)	1	13	16	0
7. Population	2,200	1,300	2,200	2,300
8. Average family size	7.6	6.6	7.4	7.9
9. No. of farm households	300	200	300	300
Of which, member	60	68	140	164
non-member	240	132	160	136
10. Average farm size(ha)	1.33	1.50	1.10	2.80



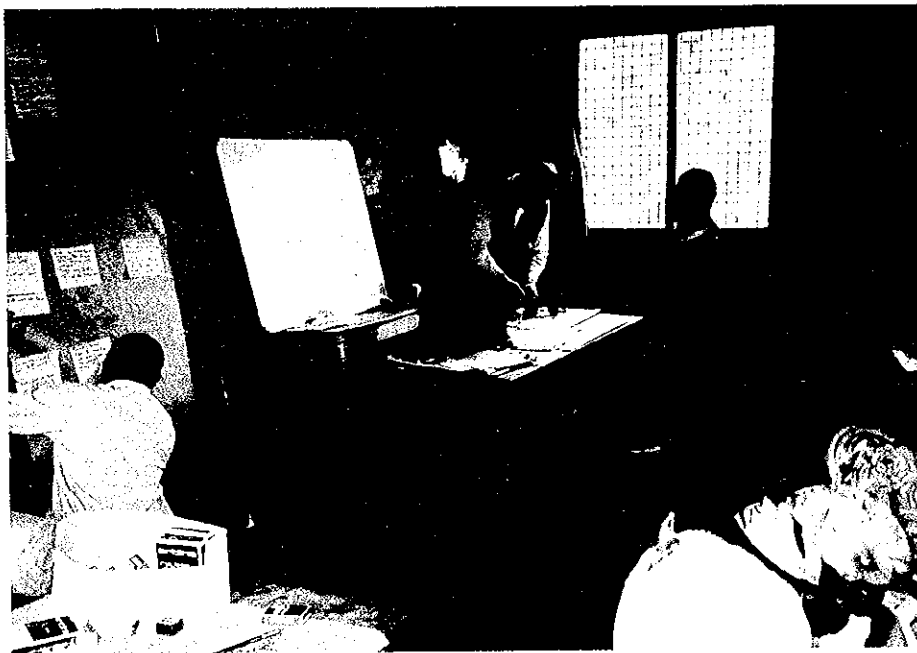
Tea plantation observed in the sloping area

Verbal information survey from farmer in the
Rupingazi Ngerwe Irrigation Scheme





Workshop seminars held at Ruungu/Karocho Irrigation Project with participation of farmers



Workshop seminars held at Nkunjumo Water Project



Workshop seminars held at Rupingazi Ngerwe Irrigation Scheme



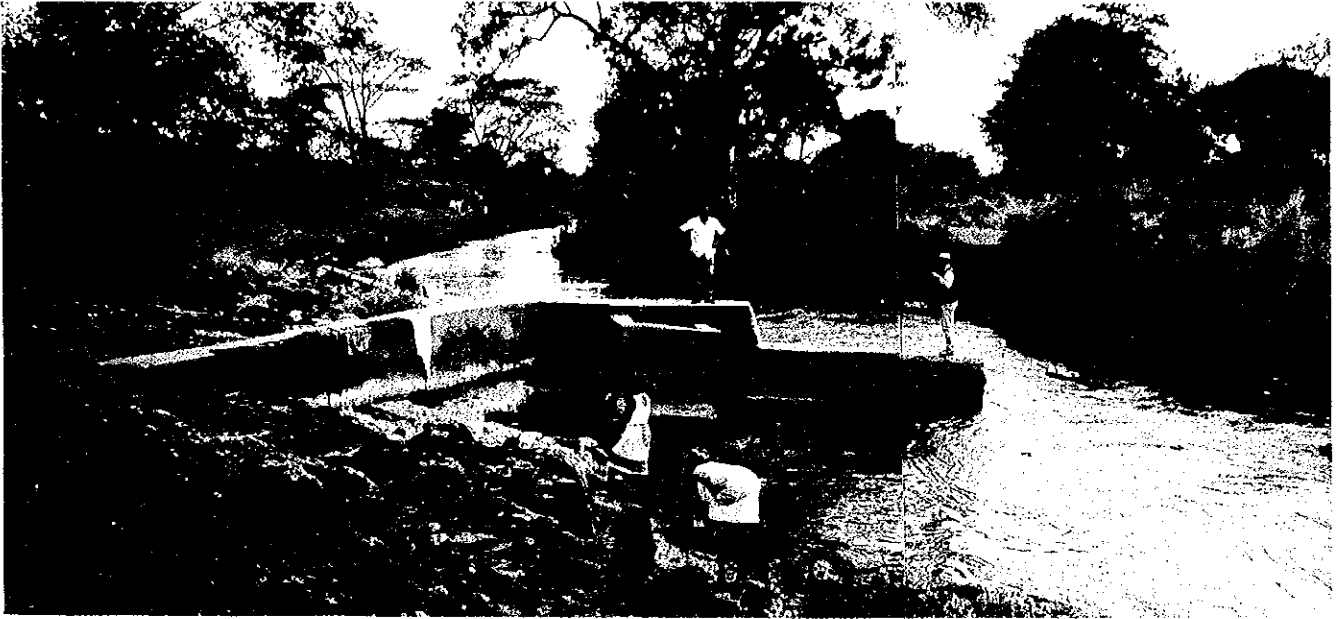
Farming by smallholder's farmers at Ciambaraga Irrigation Scheme (Type-A), under provision of sprinkler irrigation systems



Plowing works using cow in Ngomano/Nyangati Water Furrow Project, under rainfed conditions



Coffee drying works at coffee factory



Intake facilities in Ruungu/Karochu Irrigation Project,(right bank portion of intake has been washed away by the1997 flood)



Simple intake facilities provided by tree and embanked soil in Ngomano/Nyangati Water Furrow Project. Intake is washed away every year by flood.



“Three Stone Jico” of coking stove provided in homestead in Kirinyaga district



Soil conservation works by Perspalum Grass planted at edge of terrace in steep sloping coffee area(Menu district)



Land sliding site observed at main roads at about 1.0km far from Chuka town, No pasable of vehicles(Tharaka Nithi district)

1. RUPINGAZI NGERWE IRRIGATION SCHEME

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1.1 Present Conditions

1.1.1 Administration and Population

1) Administration and Rural Organization

The administration and rural organization of the Project Area can be specified using the standard Kenyan administrative units as shown below;

Province	District	Division	Location	Sub-Location
Eastern	Embu	Manyatta	Nginda	Kibugu

Rupingazi Ngerwe Project Area is located in Embu District and covers six villages, namely, Ngerwe, Kiangucu, Kathigu, Gatunduri, Kibira, and Munyuri.

Government ministries and departments are represented at various administrative levels down to the location and sometimes sub-location level.

2) Population

Due to the absence of statistical data, the population of the Project Area was estimated based on results of the farm economic survey conducted by the Study Team during the phase-III study. Population in the Area is estimated at 2,200, 300 for total household and 60 for household members in the Project Area. Family size in the Project Area is 7.6 persons per household which is larger than the national average of 5.20 persons.

1.1.2 Location, Topography and Meteorological Conditions

The Project Area with a total cultivable area of 161 ha is located on an upper elevation around 1,500 m above mean sea level with an annual rainfall of 1,364 mm. The rainy seasons are comparatively reliable, and the dry season is relatively short, with an average rainfall of 107 mm between June and September. Rain falls on about 123 days of the year. The 60 percent reliability of rainfall is quite high, with about 580-720 mm in the first rains (March-June) and 380-450 mm in the second rains (October-December). The average maximum temperature is always below 26 °C, and the minimum is between 12-15 °C. The Area is one of the wetter of the four Project Areas and is moderately cool and humid.

1.1.3 Agriculture

The soils are deep and heavy, a mixture of humic Nitosols and humic Andosols. Drainage is usually not a problem, though a compact layer may occur at depth of 40-70 cm. The site has moderately good access to the Embu market, with some restrictions during the rainy days.

The rainfed crops include early maturing maize in the first rains, and composites of other crops in the second. Beans are grown intercropped with the maize, especially during the second rain. Coffee is an important crop, grown on hillside terraces. Kale is the important vegetable crop. The occasional plantation of tea is found, as well as the occasional macademia tree. Coffee, followed by maize are the

most important crops, and increased fertilizer use, responsive maize varieties and plant protection are the most important inputs.

1.1.4 Social and Farm Economic Conditions

1) Ethnic Groups

Ethnic groups living in the Project Area are the Embu.

2) Condition of Social Capability

Community members have a history of pooling resources to assist each other on the basis of neighborhood, family or clan groups for building a house or any other labor-intensive activity. More recently, they have engaged in non-traditional forms of collective action e.g. the cooperative society for collective processing and marketing of coffee. However, the now non-performing irrigation project was initiated and implemented by the government without the community's participation thus leading to a feeling of dependency on outside intervention with regard to irrigation.

3) Educational Status of Household Head and Adult Literacy

According to the farm economic survey, the ratio of adult literacy in the Area is estimated at 87.5 percent, which is higher than those of the national average. Most household heads, however, graduated only from primary school.

4) Agricultural Characteristics

Farm Labor Availability

Number of farm labors per family was estimated based on the result of the farm economic survey conducted. As a result, 3.4 to 4.9 persons are engaged in the work concerning agricultural production. Women perform 51.1 percent of labor, so their involvement is essential for the success of any small-scale irrigation scheme.

Farm Size and Title Deed

The average farm sizes in the Project Area is 1.33 ha which is below the national average of 2.80 ha. This small farm size has affected farm household income and self-sufficiency of foods. Farm land is the most important property of farmers. However, ratio of farm households who hold authorized land title deed is as low as 70 percent in Rupingazi Ngerwe Project Area. According to the farm economic survey, farmers are seeking early execution of surveys of their farmlands by Local Land Control Board, Ministry of Lands & Settlement for the issuance of title deeds.

Self-Sufficiency in Maize

Maize is the main staple food crop for Kenyan people. It is estimated that consumption of

maize is 125.6 kg per capita per year. Self-sufficiency of maize in the Project Area is particularly low, at only 55.0 percent. Main reasons for this low self-sufficiency rate of maize are small farm size and frequent water shortage/drought, according to the farm economic survey. Aside from these reasons, current land use is also to be considered. For example, expansion of coffee cultivation will result in a shortfall in maize production.

Farm Household's Income and Its Composition

Annual household income is generally affected by land use, climatic conditions and socio-economic conditions such as distance to towns, employment opportunities etc. The following indicates the average farm household income;

- Crop income	:	62,500	(Ksh/family/year)
- Animal income	:	10,300	
- Off-farm income	:	32,500	
Total	:	105,300	

1.1.5 Irrigation Water Sources and Water Permit

The irrigation water source is the Rupingazi river. The catchment area above the intake site is about 130 sq.km, and since water usage in the upstream area is very scarce, water for irrigation are available year round. There exist one regular gauging station in the immediate downstream of the intake site, and the catchment area is 197 sq.km. The annual mean and low flow are 4.0 and 2.7 cu.m/sec, respectively. The available water at the intake site is estimated by applying observed discharge data at the regular gauging station.

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 a major tributary of the Rupingazi river.

1.1.6 Irrigation and Drainage

Total net area of farmland is 161 ha. The irrigated crops were carrot, tomatoes, French beans, etc, and furrow irrigation was adopted at on-farm level.

The irrigation system is not operated currently due to heavy siltation in the upper reach of main canal. The irrigated area, when the system was operated, was 24 ha in the upper and middle reach of the canal systems, however, the irrigation water did not reach the lower part of the area. There was no consensus among the members of WUA on water management and unfair water allocation was predominant over the Project Area. Hereafter, necessary training programs for the members on water management as well as the rehabilitation of the canal system shall be provided in the Project.

Since the Project Area is located on sloping land, there are no severe drainage problems in the Area.

1.1.7 Farmers' Organizations and Their Activities

Farmer's organization and their activities can be summarized as shown below;

Farmers' Organization	Main Activities
1) Cooperative Society	- Processing and marketing of coffee - Procuring and stocking farm inputs - Giving cash advances to members
2) Water Users' Association	- Operating irrigation system - Maintaining the irrigation system
3) Marketing Groups	- Presently absent in the Project Area
4) Women's Groups	- Assisting each other in buying household utensils - Improving houses (water tanks, roofing sheets)
5) Other Community level organizations (loose associations based on family or clan affinities)	- Providing mutual assistance during financial emergencies.
6) Non-Government Organizations (NGOs): Anglican Church of Kenya (ACK) Diocese of Embu (Catholic Church)	- Providing spiritual service and general advice on family life

Rupingazi Ngerwe Irrigation Association has been organized in the Project Area to maintain irrigation facilities and to manage group members and bylaws agreed in the group meetings. Organization of committees of WUA are usually composed of a chairman, vice-chairman, treasurer, secretary, assistant treasurer, and assistant secretary. In addition, one water guards are employed to operate water distribution and maintain canals on a daily basis.

1.1.8 Agricultural Extension Services

Agricultural extension services are available in the Project Area from the district down to the location level. Other government support consists in KARI's on-farm agricultural trials but these are fairly limited.

1.1.9 Agriculture and Rural Infrastructure Conditions

Present irrigation system is an open canal system tapping water from Rupingazi river. However, the existing system with 11.5 km earth canals has not been operated for many years due to heavy siltation caused by soil erosion from the steep mountain slopes in the upper part of the canal system. The intake weir at Rupingazi river is a small concrete structure in fair condition. Canals are all small earthen canals with canal gradients of between 1/30 and 1/770. Serious problems in the irrigation system are; 1) irrigation water does not reach the lower part of the canal, and 2) heavy siltation occurs at the upper reaches of the canal.

Domestic water has been supplied by Ngandori-A Rural Water Supply System operated by the NWC&PC. Approximately 50 percent of the households have received treated water from the Ngandori-A System. An access road with a total length of 6.3 km from Embu town to the Project Area is E632 Minor Road maintained by MPWH. Its condition is not bad but it becomes virtually impassable during rainy seasons. Village/farm roads are generally in fair condition except for some steep sections. Village/farm roads belong to Embu County Council, but road maintenance has been carried out by communities at the local level due to lack of local government funds.

As to other social infrastructures, electricity has not been supplied, the nearest public medical facility is Kibugu health center, 2.0 km from the Project Area, and Embu provincial hospital is 6.3 km distance. There is no primary school in the Project Area, but three primary schools are located in the vicinity, i.e. Kibugu, Gituri and Govio.

1.1.10 Gender Issues

While traditionally, women occupy a subordinate status in the community, recent advances in education and employment opportunities (formal and informal) have appreciably improved their status. Tradition dictates that certain tasks (cooking, fetching water and firewood, weeding, harvesting, taking care of children and the sick) be done almost exclusively by women. However these roles are nowadays somewhat modified by the community's entry into the monetary economy as well as by the influence of new institutions (churches, schools).

Tradition does not provide for ownership of land by women although they have user rights through connection to husbands or fathers. However, female empowerment through education and employment in the formal sector has led to some women purchasing land and acquiring an independent right to land. Women have control and marketing authority for subsistence crops (maize and beans), bananas, sweet potatoes and kales.

1.1.11 Marketing

Based on the field survey and results of PCM workshop seminars with the participation of beneficial farmers, current marketing situation in and around the Project Area can be presented below;

- Late of payment for produce (coffee payment is a main issue)
- Low profit of farming
- Low prices for horticultural produce
- Low quality of produce
- Poor production planning
- Poor market for the produce
- Lack of marketing organization
- Lack of marketing information
- Exploitation by middlemen
- Dishonesty of exporters of horticulture
- Lack of knowledge on requirements of export produce
- Lack of knowledge on consumers' or buyers' demand
- Selling individually coffee cherries to private coffee millers

1.1.12 Rural Environment and Public Health

Most of the farmland is in the valley of the Rupingazi river, where the gradient is very steep, and there are no any forests around the Project Area, so that farmers are collecting firewood in their farmlands. Rupingazi river is one of the five trout rivers which the Government has earmarked for fishery development in Embu District.

About 40 percent of households use tap water for drinking, and the most of others use the river water in the dry season, and the river water and the roof catchment half-and-half in the rainy season. The water quality of Rupingazi river is a little bit above the standard on BOD, HCO₃, and coliform.

The main diseases are malaria followed by diarrhea, worm infections, and respiratory tract infections. Medical facilities are underutilized partly due to lack of drugs, though all women in the Project Area attend ante-natal clinic and deliver their babies in health facilities.

The common crop management being practiced in the Area is mixed cropping in coffee field such as maize, bananas and macadamia. Most farmers practice tree plantation, Napier grass plantation and contour cultivation though there are some differences among their practices.

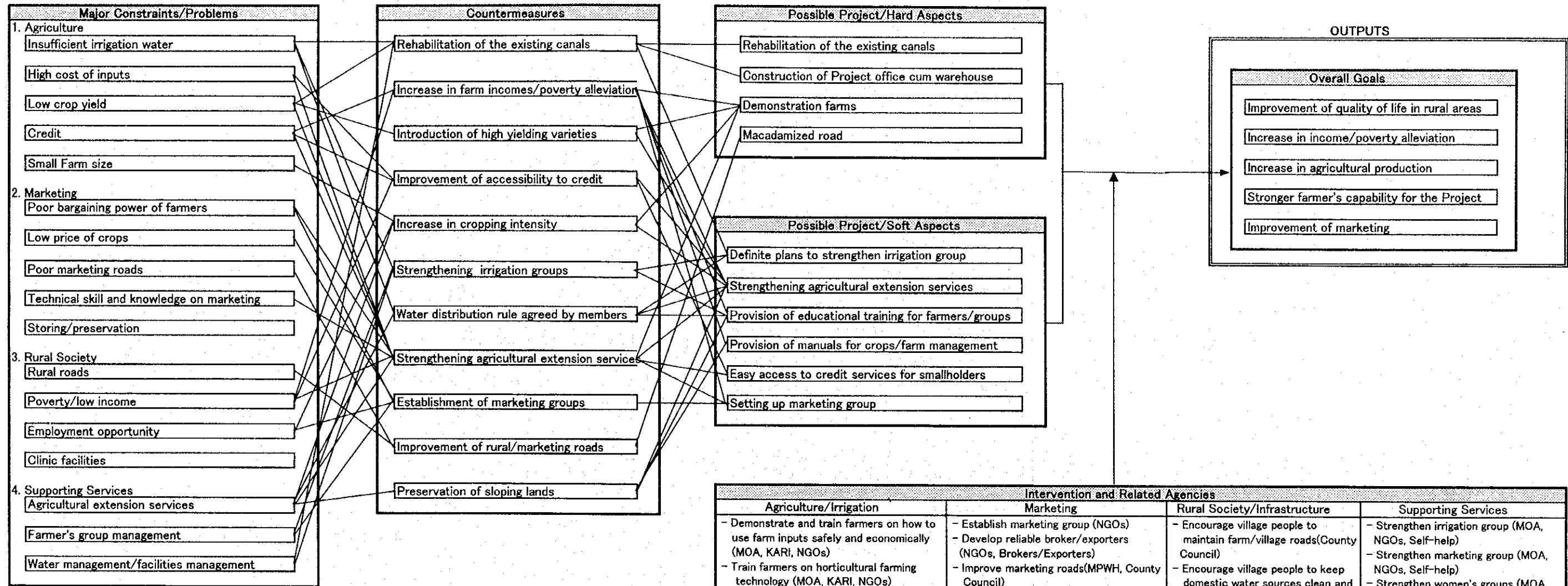
84 percent of farmers use agro-chemicals mainly against insects, leaf rust and coffee berry diseases for coffee. From the viewpoint of the environment, the condition of agrochemical dosage is not bad because many agro-chemicals are used less than the recommended quantity and the application interval is longer than that which is recommended.

1.2 Present Problems, Constraints and Development Potentials

Present problems and constraints encountered in the Area were analyzed in the following aspects, which have been obtained through fieldwork and relevant workshop seminars with the participation of related government officers, Study Team, NGOs, financial agencies, beneficial farmers, etc ;

- Agriculture
 - Insufficient irrigation water
 - High cost of inputs
 - Low crop yield
 - No accessibility of agricultural credit
 - Small farm size
- Marketing
 - Poor bargaining power of farmers
 - Low price of crops
 - Poor marketing roads
 - Lack of technical skill and knowledge on marketing
 - No provision of storing/preservation
- Rural Society
 - Poor rural roads
 - Poverty/low income
 - Lack of employment opportunity
 - No provision of clinic facilities
- Supporting Services
 - Lack of agricultural extension services
 - Weak farmer's group services
 - Lack of water management and facility management services

Necessary countermeasures and interventions to attain the overall goals in terms of hard and soft aspects are shown in Figure 1.2-1, which was obtained after due consideration of current problems and constraints mentioned above.



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
<ul style="list-style-type: none"> - 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) 	<ul style="list-style-type: none"> - 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) 	<ul style="list-style-type: none"> - 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) 	<ul style="list-style-type: none"> - 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 Goals (Rupingazi Ngerwe Irrigation Scheme)

1.3 Development Plan

1.3.1 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 program, 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 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,
- Establishment/strengthening of farmers' organization and promotion of agricultural support services,
- Environmental considerations,
- Development of agricultural and rural infrastructure,
- Construction and improvement of access roads,
- Development of post-harvest and agro-industry facilities,
- Social capability-building and institutional strengthening program, and
- Monitoring and Evaluation of the Project.

1.3.2 Community Capability-Building and Institutional Development Plan

1) Community-Capability Building Plan

General Social Preparation Plan

At the beginning of the project cycle, a PRA workshop for the local community will be conducted with the aim of establishing a sense of community identity and increased awareness about its strength and potential.

Capability-Building Plan for Farmers' Organization

Type of Farmers' Organization	Proposed Development Plan
Water Users' Association (WUA)	- Educate WUA members on requirements and implications of Irrigation - Facilitate the community in reviewing and updating the PDM - 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 - Joint meeting of Cooperative and WUA committees to agree on implications of increased irrigated horticultural production - Promotion of linkage with WUA and Production/Marketing groups
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 labor and irrigation benefits as well as their perceived role and preferences

Type of Farmers' Organization	Proposed Development Plan
Production/ Marketing Groups	<ul style="list-style-type: none"> - 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

2) Development and Capability-Building of Local NGOs

To enhance the capacity of the two church NGOs in providing support services to the project community, their staff will be trained in the following areas;

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

3) Tapping Services of Other Agencies in Undertaking Social Preparation

It is planned to encourage a coordinated 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

An IDB staff member will be appointed and trained on the job in PRA and PDM facilitation and later attend the short PRA at Egerton University. He will then conduct a social preparation session in IDB supported irrigation schemes including the Ngomano/Nyangati scheme.

5) Strengthening of IDB Field Offices

It is proposed that staff of IDB field offices at the district and divisional level will be strengthened by training them in community organization and participatory extension approaches.

6) Institutional Strengthening of District Agricultural Offices

With a view to institutionalizing contributions of these specialists, it is planned that relevant specialists at the DAO's office incorporate follow-up support services to the irrigation project in their respective operational work plans.

7) Equipment and Facility Support

To facilitate the work of IDB field staff at the district level, it is proposed that they will be provided with necessary equipment support.

8) Partnership with the Business Community

Partnership links will be developed between the various institutions operating at the project level and the business community as summarized below;

Project Institution	MOA	WUA	Cooperative	Marketing Groups
Likely	- Horticultural Exporters	- Banks	- Banks	- Horticultural exporters
Business	- Farm input Distributors	- Credit institutions	- Input-distributors	- Banks
Partner	- Local input stockists	- Contractors		- Local input stockists

9) Implementation of Capability-Building Training Workshops

As part of capability-building efforts, training workshops will be implemented within three years from the commencement of Project implementation.

1.3.3 Agriculture Plan

1) Policy for Proposed Agricultural Farming

The recommendation for proposed agricultural farming in Rupingazi Area 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.

2) Training and Demonstration for Crop Farming and Farming Techniques

The main interventions proposed here are training, trials and demonstrations focussing on increasing the intensity of the current crop production, maximizing the production of food crops, especially maize, plus the development of a small area of new crops for sale.

1.3.4 Water Sources Development Plan

The available water source for the Area is run-off water from the Rupingazi river. The minimum amount of available water at the intake site is estimated at 0.185 cu.m/sec based on the available discharge data and authorized water permit amount in the immediate downstream of the intake site.

The maximum irrigation requirement for the requested irrigation area (40 ha) by the WUA is roughly estimated at 0.080 cu.m/sec without considering the cropping pattern to be introduced for the Project. As the available river water at the intake site exceeds the maximum irrigation requirement, the area of 40 ha is irrigable. Thus, it is planned that the required water for the Project could be diverted through the existing intake facilities.

1.3.5 Irrigation and Drainage Plan

The area to be irrigated is 40 ha. The crops to be introduced in the Project, such as maize, grain maize, coffee, bananas, cabbage, French beans, onion etc. are selected considering the various factors which are dominant in and around the Project Area. As an irrigation method, surface and sprinkler irrigation methods are adaptable from the topographic condition of the Area, and as a working time for irrigation, 12 hours operation per day and six working days per week are adopted.

The maximum water requirements in case of surface and sprinkler irrigation methods are estimated at 63.6 lit/sec and 48.9 l/sec, respectively, based on the proposed cropping pattern. The irrigation interval is decided at seven days considering the crops to be introduced, soil texture and TRAM values, etc.

Regarding the water management method, two water distribution systems are proposed; one system will be an open canal system with a single rotation block and the other system will be a pipeline system with plural rotation blocks. From the viewpoint of construction costs for the irrigation facilities, the former system is proposed.

1.3.6 Institutional Development Plan for Farmers' Organizations

Type of Farmers' Organization	Development Plan
Water Users' Association	<ul style="list-style-type: none"> - Using PRA approaches, educating WUA members on irrigation implications - Training management committee on financial and general management: water charges, financial accounting, planning for operation and maintenance, budget preparation, management and organization principles. - Promoting linkages with other institutions such as MOA, Department of Water Development, Cooperative Society, local NGO as well as the private sector.
Cooperative Society	<ul style="list-style-type: none"> - Joint workshop between cooperative society and WUA committees aimed at exploring areas of co-operation - Training management committee in operational cost management, improved budget control procedures and elementary principles of management. - Strengthening linkages with MOA, Ministry of Cooperative Development, farm input suppliers and banks
Marketing Group	<ul style="list-style-type: none"> - Promoting marketing groups and training of prospective members on registration requirements and procedures - Training group members in financial and general management matters including produce documentation, accounting procedures, banking and management principles. - Formation of linkages with WUA, MOA, HCDA, local NGOs, banks, producer buyers as well as local input suppliers.
Women's Group	<ul style="list-style-type: none"> - Convening workshop for existing women's groups where members will identify women's concerns, needs and priorities - Facilitating review of proposed irrigation project from women's perspective and identifying opportunities for women-specific benefits - Training women's groups in financial record-keeping, banking, and general management. - Encouraging linkages with MOA, HCDA, local NGOs, produce buyers, input suppliers as well as banks.
Other Groups	<ul style="list-style-type: none"> - Encouraging them to upgrade into production/marketing groups

1.3.7 Institutional Support System Development Plan

Staff of various agencies will be exposed to training sessions aimed at enhancing their capability to strengthen farmer organizations. Such training will include; community organization, participatory approaches, management and organization principles.

1.3.8 Marketing Plan

In order to improve the marketing situation in the Area, following interventions and activities are proposed through the careful analysis of present problems in marketing aspects.

Proposed Interventions and Activities for Marketing Plan

Problems/Constraints	Interventions/Activities	Agency/Operation Body Concerned	Outputs
[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	- 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] Low prices for horticultural produce	- Seminar on varieties and certified seeds information at JKUAT and other institutions managed by the government	- KARI-HQ - Farm inputs/marketing officer in DAO-Embu	- Better yields and plant protection - Assurance of germination rate
[3-1] Low quality of produce	- Provision of certified seed procurement information	- Marketing expert-HCDA-Embu - KARI-Embu	
[3-1-1] Poor production planning	- 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 through PCM workshop at JKUAT and other institutions managed by the government	- MOA staff on farmers' organization	- Organization of small scale marketing groups
[3-2-1] Lack of marketing organization	- 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
[3-2-2] Lack of marketing information	- Group loading and transport arrangement for local consumed produce	- Marketing group	- Better transaction conditions than middlemen system

Problems/Constraints	Interventions/Activities	Agency/Operation Body Concerned	Outputs
[3-3] Exploitation by 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 - Provision of market price information at Nairobi Horticultural Center (auction results) for export produce	- Marketing expert of HCDA - Representative of exporters or FPEAK staff - Marketing expert of HCDA-Embu	- More stable income and better crop planning - Organizing small scale marketing groups - Increasing bargaining power for negotiation in prices (bonus added to contract minimum prices to meet price escalation)
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 Center 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

1.3.9 Physical Plan and Cost Estimate

For irrigation system improvement, alternative study was made between an open canal system and a pipeline system. As a result of the study, an open canal system is recommended. The improved irrigation system shall include installation of pipe conduit to eliminate siltation problems and division boxes to improve water distribution management. All other facilities including intake weirs shall remain.

As to rural roads, rehabilitation and improvement of the 1.2 km for village/farm roads and 6.3 km for access roads are planned. Steep road sections of access roads on B632 Minor Road shall be improved with tarmac pavement.

Project costs consist of two categories, i.e. construction cost, and community development and support services cost. Total project costs are estimated at 35.0 million Ksh, of which 4.5 million Ksh will be repayment costs by beneficial farmers. Annual operation and maintenance (O&M) costs for facilities are 339 thousand Ksh.

1.3.10 Project Implementation and Operation and Maintenance Plan

1) Overall Project Implementation Plan

An Executive Steering Committee (ESC) under the chairmanship of the Permanent Secretary of MOA and a Technical Working Committee (TWC) shall be established for smooth implementation of the project. Moreover, under TWC, District Project Management Office (DPMO) shall also be organized at the district level.

Project implementation is classified into two categories, i.e. facilities' construction, and community development and support services. Implementation of community development and support services including social preparation and institutional strengthening shall be rendered by suitable agencies such as consultants and NGOs. Facility construction shall be implemented through labor-intensive methods on a contract basis with local contractors under the supervision of DPMO. Self-help projects such as irrigation improvement, of which costs are to be borne by WUA under the cost recovery concept are supervised by NGOs. On the other hand, public projects such as roads improvement to be financed by the government are carried out by Consultants under the direction of District Road Engineer (DRE). The community initiative in carrying out the implementation should always be considered, particularly for self-help projects.

The total implementation period is assumed to be seven years in consideration of social preparation and fund procurement for self-help projects as critical factors on implementation.

Executing agencies/bodies for the operation and maintenance of facilities are MPWH for access roads, Rupingazi Ngerwe Irrigation Association for irrigation facilities and village communities for village/farm roads.

2) Capability Building Implementation Plan

Capability-building during project implementation will be conducted by various agencies as shown below;

Project Stage	Agency	Type of Capability-Build-up Service
1. Project Planning	a) MOA/IDB	- Social preparation of project community - Facilitation of WUA planning sessions (activities, subactivities)
	b) MOA/DAO	- Acting as resource persons during social preparation sessions
	c) Local NGOs	- Acting as resource persons during social preparation sessions
2. Project Design	a) MOA/IDB	- Facilitating WUA design review sessions (availing design model, explaining design criteria and expected mode of operation of design elements) - Actively seeking women's input into the design
	b) MWR	- Awarding and securing water rights for WUA
	c) Local NGOs	- Acting as resource persons
3. Project Funding	a) MOA/IDB	- Advising on project costing and alternative sources of project funding - Explaining funding conditions and procedures for various funding agencies
	b) Local NGOs	- Training WUA members on group formation for security fund contributions, banking operations, loan funds & loan servicing procedures
	c) MOCSS	- Assisting farmers on harambee organization
	d) Provincial Administration	- Facilitating harambee organization by issuing license
4. Project Construction	a) MOA/IDB	- Advising WUA on criteria for tender assessment and contractor selection, required supervision and quality control aspects of construction activities
	b) Local NGOs	- Training WUA committee on contractor payment procedures
5. Project (O&M)	a) MOA/IDB	- Facilitating and acting as resource persons during O&M sessions
	b) MOA/DAO	- Acting as resource persons during O&M sessions

Related agencies for providing support services after project implementation are as follows;

Agency	Type of Support Services
KARI	- On-farm horticultural research aimed at solving problems relating to low crop yields, crop pests diseases and lack of appropriate crop introductions.
MOA	- Planning, executing and monitoring extension services and paying special attention to production/market groups as well as women groups - Facilitating a one day annual review of irrigation project performance by farmers and other stake holders. - Strengthening artisan and entrepreneurial skills that will be needed during the operation and maintenance phase. - Fostering farmers capability by awarding prizes every year to the best three irrigated horticultural farmers within the project.
Local NGOs	- Giving support in planning courses of action on other problems facing the community.

1.3.11 Environmental Management Plan

The extension service and farmers' training by MOA shall include the encouragement of soil and water conservation activities, the risk and appropriate use of agrochemical and promotion of improved cooking stove for women's groups.

Sanitary education for children at primary school is required to protect against intestinal worms and diarrhea. Water quality analysis of the sources of drinking water is required periodically and the result shall be informed to the inhabitants, so that they can learn which water source is more safety.

The Rupingazi water catchment area lies mostly within Mt. Kenya Forest Reserve. Therefore, the management of Mt. Kenya Forest shall be strengthened by Forestry Department against illegal logging.

1.4 Project Evaluation and Cost Recovery

1.4.1 Economic Evaluation

The Project was evaluated from the national economic point of view by using EIRR as an index. EIRR of Rupingazi Ngerwe Irrigation Scheme is estimated at 6.3 percent which is below the national standardized EIRR of eight percent for agricultural project. If including mapping costs, which are not included in the project costs, because JICA Study Team made it, EIRR is 6.1 percent.

1.4.2 Financial Analysis

Financial analysis for typical farms was made to compare their farm economy in case of with-project and without-project. Farm income including animal income and off-farm income will increase as compared with without-project cases. Farm income in this Area is estimated as follows;

- Without Project : 98,237 (Ksh/farm/year)
- With Project : 108,166

1.4.3 Cost Recovery

Amortizing conditions for the small-scale irrigation projects in the Area should be decided based on the results of the financial analysis, rather than based on the present loan conditions. Therefore, cost recovery was studied to justify the farmer's ability for repayment by changing credit conditions such as interest and repayment period, and monthly repayment in each case was calculated, and then compared with the estimated disposable incomes which were calculated in the financial analysis. Amount of monthly repayment based on the current and recommended loan conditions is shown below;

	Excluding Mapping Costs	Including Mapping Costs
- Monthly repayment under current loan conditions	: 632 (Ksh/farm/month)	705 (Ksh/farm/month)
- Monthly repayment under proposed loan condition	: 436	486

1.5 Recommendations

Agriculture

- a) The current dominant farming type in the Rupingazi Ngerwe Irrigation Scheme, which was classified as a Type-B in Model Area selection, is commercial-based coffee farming, and beneficial farmers have such strong willingness that present farming type should be shifted to commercial-based coffee farming in combination with horticultural crops in the Area. Therefore, plan of agricultural farming in the Area should be formulated in the direction mentioned above.
- b) The trials and demonstrations will be conducted by the GOK staff in Agricultural Extension and Irrigation Development Department. The recipients will be the smallholders. The trials and demonstrations will be conducted on farmer's fields. The actual timing will be determined by the nature of the trial, and preparations will have to be made in advance of the planting season. The frequency will be as shown below. The method will be in collaboration between individual farmers and the project.

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Demonstrations	2	2	1	1	1	7
Trials	2	2	2	1	1	8

- c) The training programs on crop cultivation will be conducted by GOK staff and hired professionals from private sectors. They will be given to interested farmers, and will be held in the field near to the irrigation scheme, in churches, meeting halls etc. for the periods of approximately every six months for the first two to two and a half years. These training programs will be linked to the trials and demonstration farms.

The programs will include topics such as selection of new varieties (e.g. maize hybrids) and how their production differs from traditional varieties, water management and irrigation techniques, animal nutrition including the use of urea supplement blocks, etc.

d) Others

- Introduction of adapted improved maize lines,
- Supply of virus free/improved planting materials,
- Implementation of trials of urea supplement blocks,
- Test of impact of deep plowing on plant growth

Institutional Supporting Services

- a) The District Irrigation Unit at Embu liaises with IDB, Nairobi in drawing a training program specific to Rupingazi Ngerwe Irrigation Scheme for social preparation of the community and capability-building of relevant agencies such as Department of Social Services and private sectors.
- b) DPMO should draw a training timetable for social preparation and capability building of relevant agencies.

Irrigation and Drainage

- a) Considering the current situation whereby the proposed irrigation areas of 40 ha are spread over total farmland of 161 ha along the existing open canal with a length of 10.7 km with irrigation water diverted directly from main and/or lateral canal directly through temporary gap, it is recommended to introduce a water management plan with a single rotation block with six irrigation groups. The WUA shall decide the area and location of proposed farmland to determine design capacity of the irrigation canal before the commencement of detailed design study.
- b) In order to realize effective water management, a water management manual shall be prepared by employed consultants. As to the content of the manual, the following items as well as general techniques of water management shall be included, and training members of the WUA, especially for members in the downstream area who have no experience on irrigation, shall be provided before actual irrigation begins.
 - Adaptive organization for water management (general water management method for total system, organization of irrigation group)
 - Water operation rule (method of water distribution, observance of standard cropping pattern, formulation of penalty)
 - Water distribution method within the irrigation group (irrigation turn, irrigable area)
 - Irrigation method (furrow length, water application time per unit area)
 - Irrigation schedule

- c) It is recommended to obtain a water permit from the MWR

Marketing

- a) Discussion and formulation of farmer's marketing groups,
- b) Contract farming with exporters as a marketing alternative,

- c) Practical utilization of social and natural resources for marketing advantages, i.e., i) huge inflow of horticultural produce into Embu wholesale market from other districts, ii) introduction of coffee cherry advance payment system (CAPS), iii) group buying system of farm inputs by coffee societies, iv) competition among macadamia nuts companies, v) use of organic fertilizer, vi) potential of production of export crops and farming contract, vii) facilities such as sheds and warehouses at coffee factory,
- d) Participation to related seminars for smallholders held at Jomo Kenyatta University of Agriculture and Technology (JKUAT) and other institutions managed by the government,

Agricultural and Social Infrastructure

- a) Basic plan for the irrigation improvement shall be finalized based on feasibility study results through workshop meetings to be held with participation of association members before commencement of the detailed design.

Project Implementation

- a) The main implementing agency of the Project is MOA, however, close cooperation and adjustment of work demarcation should be made among related government agencies such as MPWH, MOWR, MEC, etc, since the Project involves many project components being related to each other.
- b) For the construction work of the self-help projects, detailed work allocation and responsibilities, as indicated below, among Contractors, WUA and NGOs, which are directly related to the construction cost, shall be clearly presented to WUA in the detailed design stage;
 - Contents of works to be contributed by WUA in the form of labor,
 - Responsibility of procurement and management of materials, equipment and skilled labors, and
 - Responsibility of work quality and schedule.
- c) In the course of project implementation, farmers/farmers representatives should make reference to the on-going activities of classified Type-A smallholder irrigation schemes such as Ciabarage Irrigation Scheme in Tharaka Nithi and Muguna Water Project in Meru district for their horticultural development.
- d) For the planning of irrigated horticultural development for each Model Area, Study Team prepared the topographical maps with scale of 1:5,000 applying aerial photography and ground survey methods. Its cost was about 669 thousand Ksh per site (average size is 276 ha). These topographical maps were deemed essential and useful not only for carrying out physical planning of irrigation and drainage facilities in the Area, but also encouraging farmers' participation in the project with their awareness of common ownership for community resources.

In the project evaluation, the required costs for preparation of the topographical map mentioned above were not counted because the Study Team will cover the burden of costs. However, when other projects are planned, such topographic maps with scale of 1:5,000 should be prepared and these required costs should be shouldered by the beneficiary groups themselves.

Environment

- a) Promotion of horticultural crops should be limited to the gently sloping farmland. On the other hand, improvement of coffee-growing techniques and the management of coffee societies, and the possibility of fruit-tree growing, etc. should be examined for planting on the steep slopes of the Area.
- b) From the viewpoint of the rural environment, MOA should support horticulture as well as livestock raising, production of feed and manure synthetically. Extension officers of the MOA should improve the know-how in agriculture and livestock-raising. Further, it is important to approach the plan in combination with other projects executed or being executed by other donors.

Project Economy and Farm Budget

- a) It is recommended for the preparation of the detailed project plans of the proposed small-scale irrigation schemes that MOA should undertake a careful appraisal to examine project plans to be proposed by the communities concerned, placing emphasis on the appropriateness of the technology designed for irrigation systems and the accuracy of the cost estimate to be based on lowest-cost approaches.

In almost all the small-scale irrigation projects, many farmers are confronted with difficulty in loan repayment. This holds true even for the farmers of Ciambaraga Irrigation Schemes in Tharaka Nithi district, one of the more well-managed projects among the 463 reviewed. Accurate cost estimates are important, since the cost is a crucial element in determining the financial and economic viability of the project and also for planning its funding.

- b) It is recommended that prior to the implementation of the project, a farm budget analysis of the representative farms should be conducted, through detailed farm surveys, with the primary objective of providing the basis for an assessment of the investment plans and debt repayment capacities of the farmers.

The farm budget analysis also provides a basis for setting repayment terms and conditions for credit that will be enough to encourage the farmers to participate in the project and make sure that the farmers will have sufficient cash to repay the loan. The ability of the farmers to pay is an instrument for promoting sustainability.

- c) It is recommended that intensive backing should be given to the farmers participating in the project until they have attained the full production target, since it may take several years to reach this target. To this end, the district governments should establish the District Project Management Office (DPMO), responsible for providing support services to the farmers, as proposed in this study.

The proposed DPMO shall formulate support services programs in close coordination with HCDA, FPEAK, DAO and NGOs as agricultural development could be realized only with the full cooperation of the agricultural services agencies, as well as the cooperation of the private entities concerned.

Project Monitoring

- a) Monitoring of the progress and implementation of the project should be carried out by external agencies under the supervision of the Executive Steering Committee (ECS), to cope with the following objectives;
- To obtain and judge how many goals and targets initially formulated under the Project are attained,
 - To judge whether or not follow-up support is required from the viewpoint of project sustainability under self-help management, and
 - To learn lessons, both positive and negative, from the Project in order to apply to other project areas for implementation.
- b) Monitoring work shall be conducted on the following items;
- Irrigation system operation
 - Access and village/farm roads maintenance
 - Agricultural aspect
 - Institutional aspect
 - Marketing aspect
 -
 - Farm economy aspect
 - Control of soil erosion and watershed management

Table 1.5-1 indicates the required training items for the implementation of smallholder irrigation schemes in Rupingazi Ngerwe Irrigation Scheme.

Table 1.5-1 Required Training Items for Rupingazi Ngerwe Irrigation Scheme

	Training Items	Farmers/ Farmers' Group	Implementing Staff
1. Agriculture/Irrigation	- Land use in combination with coffee plantation		●
	- Irrigated and rainfed crop farming for both horticulture and food crops	●	
	- Establishment of cooperative society to purchasing agricultural inputs	●	
	- Application of farm input	●	
	- Water saving farming	●	
	- Water management in open canal system with long length	●	
	- O&M works for irrigation facilities in a slopping area	●	
	- Management of trial and demonstration farms	●	
	- Monitoring of the project		●
	- Development of farm and water management manuals		●
	- Maximum residue levels (MRLs) and crop assurance for export crops	●	
2. Marketing	- Establishment/strengthening of marketing group	●	●
	- Marketing techniques for both horticulture and food crops to brokers/exporters	●	
	- Promotion of contract farming	●	●
	- Collection/compilation of market information	●	●
	- Rehabilitation of access roads		●
3. Rural Society/Infrastructure	- Capability-building for farmers/farmers' group and implementing staff	●	●
	- Promotion of women's participation to the project	●	
	- O&M for water source facilities for rural water supply	●	
	- Construction and O&M of village and farm roads	●	●
4. Support Services	- WUAs' roles and performance	●	
	- Financial management for cooperative societies	●	●
	- Processing techniques for coffee produce	●	
	- Access to agricultural credit	●	●
5. Environment	- Soil erosion control at sloping farms	●	●
	- Watershed Management and water conservation	●	●
	- Promotion of improved cooking stove	●	

2. NGOMANO/NYANGATI WATER FURROW PROJECT

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2.1 Present Conditions

2.1.1 Administration and Population

1) Administration and Rural Organization

The administration context of the Project Area can be specified using the standard Kenyan administrative units as shown below;

Province	District	Division	Location	Sub-Location
Central	Kirinyaga	Mwea	Nyangati	Nyangati

Ngomano/Nyangati Project Area is located in Kirinyaga district and covers only one village, namely, Nyangati.

Government ministries and departments are represented at various administrative levels down to the location and sometimes to sub-location level.

2) Population

Due to the absence of statistical data, population of the Project Area was estimated based on the results of the farm economic survey conducted by the Study Team during the phase-III study. Population in the Area is estimated at 1,300 for total population, 200 for total household and 68 for member household of the Project. Family size in the Project Area averages 6.6 persons per household which is larger than the national average of 5.2 persons.

2.1.2 Location, Topography and Meteorological Conditions

The Project Area with a total cultivable area of 381 ha is located at the medium altitude of about 1,200 m above mean sea level with an annual rainfall of 1,014 mm. The rainy seasons are comparatively short, the dry season is intense, an average of only 45 mm rainfalls between June and September, and rain is definitely becoming limited. Rain falls on about 85 days of the year. The 60 percent reliability of the length of the first rains is approx. 85-105 days, and of the second 80-95 days. The 60 percent reliability of rainfall is also low, about 380-460 mm in the first rains (March-June) and 280-330 mm in the second rains (October-December). The average maximum temperatures are always below 30°C, and the minimum's between 13-17°C. The site is dryish and moderately warm.

2.1.3 Agriculture

The soils are a mixture of eutric Nitosols and pellic Vertisols. Drainage is a problem on the Vertisols and in some places on the Nitosols. The site has good access to the markets of Kutus, Kerugoya and Nairobi via tarmac roads.

The rainfed crops include early maturing maize in the first rains, and composites of the crops in the second. Beans are grown especially during the second rains. Sweet potatoes, onions and tomatoes would all respond to supplemental irrigation in the first rains. Mangoes, pawpaws would

both do well. Maize is the most important crop, and nitrogen fertilizer correctly applied is the most important input as cropping intensities increase.

2.1.4 Social and Farm Economic Conditions

1) Ethnic Groups

Ethnic groups living in the Project Area are the Kikuyu. The Kikuyu is an ethnic group which inhabits the central part of Kenya and are known as the agricultural people. Among the Kikuyu, the head of family is the custodian of such family property such as land and livestock.

2) Condition of Social Capability

Community members have a history of pooling resources to assist each other on the basis of neighborhood, family or clan groups for building a house or any other labor-intensive activity. More recently, they have engaged in non-traditional forms of collective action e.g. the cooperative society for collective processing and marketing of coffee as well as in undertaking the present irrigation project.

3) Educational Status of Household Heads and Adult Literacy

The ratio of adult literacy in the Area is estimated at 90 percent based on farm economic survey, which is higher than the national averages. Most of the household heads, however, graduated only from primary school, followed by secondary school.

4) Agricultural Characteristics

Farm Labor Availability

Numbers of farm labors per family were estimated based on the result of the farm economic survey conducted. The result shows that 4.2 persons are engaged in the works for agricultural production. Women perform almost 45.8 percent of farm labor, so their involvement is essential for the success of small-scale irrigation schemes.

Farm Size and Title Deed

The average farm sizes in the Project Area are 1.50 ha which is below the national average of 2.80 ha. This small farm size has affected farm household income and food self-sufficiency. Farm land is the most important property of farmers, however, ratio of farm households who hold authorized land title deeds is low. According to the farm economic survey, farmers are seeking early execution of survey of their farmlands by the Local Land Control Board, Ministry of Lands & Settlement for issuance of title deeds.

Self-Sufficiency in Maize

Maize is the main staple food crop for Kenyan people. It is estimated that consumption of maize is 125.6 kg per capita per year. Self-sufficiency in maize in the Project Area is particularly low at 49.0 percent. Main reasons of this low self-sufficiency rate of maize are small farm size and frequent water shortages/drought, according to the farm economic survey.

Farm Household's Income and Its Composition

Annual household income is generally affected by land use, climatic conditions and socio-economic conditions such as distance to towns, employment opportunities etc.

- Crop income : 40,800 (Ksh/family/year)
- Animal income : 3,100
- Off-farm income : 14,600
- Total : 58,500

2.1.5 Irrigation Water Sources and Water Permit

The irrigation water sources are the Murubara river and its tributary, the Gakuo river. The catchment area above the intake site is only 25 sq.km. Since water is transferred via a canal from the Thiba river to the Gakuo river, irrigation water is available throughout the year.

There exists one regular gauging station in the Thiba river, and the catchment area is 353 sq.km. The annual mean and low flow are 10.5 cu.m/sec and 6.8 cu.m/sec, respectively. The available water at the intake site is estimated by applying observed discharge data at the regular gauging station.

The authorization of water permit belongs to MWR. The Scheme has not yet applied for a permit to the Ministry. There exist six projects holding water permits in the upper basin of the Scheme, and the total amount of authorized water is 0.002 cu.m/sec. No water permit exists in the downstream.

2.1.6 Irrigation and Drainage

Total cultivable area of farmland is 381 ha. The irrigated crops are tomatoes, French beans, maize, kale etc, and furrow irrigation is adopted at the on-farm level.

The open canal with a length of about 4.5 km exhausts the irrigation water after flowing the first three kilometers from the intake site, due to heavy seepage from the earth canal. Consequently, irrigation water does not reach to the lower part of the area. There is no consensus within the members of WUA on water management and unfair water allocation is common throughout the Project Area. Hereafter, training of the members on water management as well as the rehabilitation of existing temporary weir and canal system shall be provided for the Project.

As a part of the irrigation area is too flat to enable natural drainage, some areas suffer from excess water caused by intensive rainfall during the rainy season. To eliminate the danger of crop damage from inundation, some drainage improvement shall be considered.

2.1.7 Farmers' Organizations and Their Activities

Farmers' organizations and their activities may be summarized as shown below;

Farmers' Organization	Main Activities
1) Cooperative Society	- Processing and marketing of coffee - Procuring and stocking farm in-puts - Gives cash advances to members
2) Water Users' Association	- Operating irrigation system - Maintaining the irrigation system
3) Marketing Groups	- Presently absent in the Project Area
4) Women's Groups	- Assisting each other in buying household utensils and improving houses (water tanks, roofing sheets)
5) Other Community level organizations (loose associations based on family or clan affinities)	- Providing mutual assistance during financial emergencies
6) Non-Government Organizations (NGOs): Anglican Church of Kenya (ACK) Diocese of Embu (Catholic Church)	- Providing spiritual services and general advice on family life

Ngomano/Nyangati Water Furrow Association has been organized in the Project Area to maintain irrigation facilities and to manage group members and bylaws agreed in the group meetings. Organization of committees of WUA are usually composed of chairman, vice-chairman, treasurer, secretary, assistant treasurer, assistant secretary, and, in addition to these, there are one water guards are employed to operate water distribution and maintain canals on a daily basis.

2.1.8 Agricultural Extension Services

1) Institutional Extension Services

Agricultural extension services are available in the Project Area from the district down to the location level. Other government agricultural support services like HCDA provides occasional training on horticultural grading.

2) Agricultural Extension Services by the Private Sector

Extension services by the private sector mainly consist in advice given by contract horticultural buyers who also provide inputs as part of the contract agreement.

2.1.9 Agriculture and Rural Infrastructure Conditions

The present irrigation system is an open canal system tapping water from the Murubara river. Existing system with eight kilometer earth canals is functioning and fairly operated. The intake facility at Murubara river is a temporary wooden weir which is washed away by floods two to three

times every year. Canals are all of earth with gradient between 1/130 and 1/370. Major problems in the irrigation system are; 1) irrigation water does not reach the lower reaches of the canal, and 2) intake weir needs to be a permanent structure to attain reliable water intake and to reduce maintenance work for the temporary weir.

There is no piped water system for domestic water in the Project Area, hence inhabitants take water from springs, shallow wells, streams and canals. There are four springs which never dry up and are used as a major source of domestic water. Shallow wells are the open dug-well type, owned by individual household. Access road is in very good condition with B6 National Trunk Road maintained by MPWH. Village/farm roads are generally in fair condition except for some steep sections. Village/farm roads belong to Kirinyaga County Council but road maintenance has been carried out by communities as needed by them due to lack of funds in the local government.

As to other social infrastructures, electric power has not been supplied, nearest public medical facility is Kimbimbi health center, two kilometers from the Project Area. Embu provincial hospital is 16 km away. Nyangati primary school and Nyangati Youth Polytechnics are located in the Project Area. Three secondary schools are located in the vicinity area, i.e. Karoti, Moya and Kutus.

2.1.10 Gender Issues

The status of women within the Project Area is comparatively high owing to the following factors;

- The project community consisting of immigrants who are relatively free from traditional attitudes
- Recent advances in women's education and employment opportunities (formal and informal)
- Earnings from Nairobi and other urban centers

Ownership of land by women through purchase is not rare and is expected to increase as they become empowered through employment. For a majority of women, however, access to land is through connection to husbands or fathers. Women have control and marketing authority for subsistence crops (maize and beans), bananas, sweet potatoes, kales, etc.

Although somewhat modified by the impact of modern institutions, differentiation of gender roles is still largely determined by custom and tradition where such tasks as cooking, fetching water, taking care of children etc., are regarded as exclusively women duties.

2.1.11 Marketing

Based on the field survey and results of PCM workshop seminars with the participation of beneficial farmers, present marketing situation in and around the Project Area can be presented below;

- Middlemen set lower prices for the produce

- Exploitation of farm produce by exporters
- Poor marketing arrangements
- Long distance to selling points
- Poor access roads
- Poor storage for products
- Lack of electricity
- Lack of knowledge on requirements on export produce
- Lack of marketing organization
- High losses due to bad weather conditions
- Lack of knowledge on consumers' or buyers' demands

2.1.12 Rural Environment and Public Health

The water source of the Project Area is the Murubara river. Farmlands are spread in the catchment area and there are no forests around the Project Area, so that the farmers are growing trees for firewood on their farmland.

As for drinking water, 54 percent of households use the furrows and the river, and 27 percent use springs in the dry season. In the rainy season, 35 percent use the furrows and the river, and 11 percent for springs, 40 percent for rain water, respectively. The water quality of Murubara river is slightly above the standard, though it is better than some wells including deep wells.

Malaria ranks as the top disease in Nyangati Location followed by intestinal worms and diarrhea. Medical facilities are underutilized partly due to lack of drugs, though all women in the Project Area attend ante-natal clinic and deliver their babies in health facilities.

Generally, the farmers are active in soil conservation. Many farmers plant trees, grow Napier grass and practice contour cultivation by crop rotation and intercropping with leguminous crops. *Grevillea robusta* is the common tree planted to hedge the farmland.

70 percent of farmers use agrochemicals mainly for French beans and tomatoes. 75 percent of agro-chemicals are used within the recommended dilution including 51 percent less than the recommended dilution. However, 29 percent of agrochemicals, insecticide and fungicide for French beans and tomatoes are used on a shorter than the recommended interval.

2.2 Present Problems, Constraints and Development Potentials

Present problems and constraints encountered in the Area were analyzed in the following aspects, which have been obtained through fieldworks and relevant workshop seminars with a participation of related government officers, Study Team, NGOs, financial agencies, beneficial farmers, etc ;

- Agriculture
 - Insufficient irrigation water
 - High cost of inputs
 - Low crop yield
 - No accessibility to agricultural credit
 - Small farm size
- Marketing
 - Poor bargaining power of farmers
 - Low price of crops
 - No provision of post harvest facilities
 - Low reliance between farmers and brokers/exporters
- Rural Society
 - Poverty/low income
 - No provision of domestic water supply
 - Lack of health clinic facilities
 - Poor accessibility of rural roads
- Supporting Services
 - No provision of agricultural credit
 - Lack of agricultural extension services
 - Weak farmer's group management
 - Lack of water management services and facility management
 - Lack of knowledge on grading/processing

Necessary countermeasures and intervention to achieve overall goals in terms of hard and soft aspects are shown in Figure 2.2-1, which was obtained after due consideration of present problems and constraints mentioned above.

2.3 Development Plan

2.3.1 Objectives and Components of the Project

1) Objectives of the Project

Current dominant farming type of the Ngomano/Nyangati Water Furrow Project, which was classified as Type-C in Model Area selection, is the diversified commercial basis type of agriculture and consumption-oriented, and beneficial farmers are requesting that such present farming type will be shifted to the commercial-based horticultural farming. This project follows the proposed scheme, which is characterized with easy accessibility to Area from main roads, low construction costs per hectare, high percentage of horticultural cropping.

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 with new construction and rehabilitation of irrigation and drainage facilities for 48 ha, improved management of sustainable horticultural farming for sale a mixture of both export and domestic vegetables such as maize, bananas, French beans, specialty beans, tomatoes, onion, and melons, organization of small-scale farmers of 120 households, and sustainable assistance and support by related government agencies, NGOs, private sectors, etc.

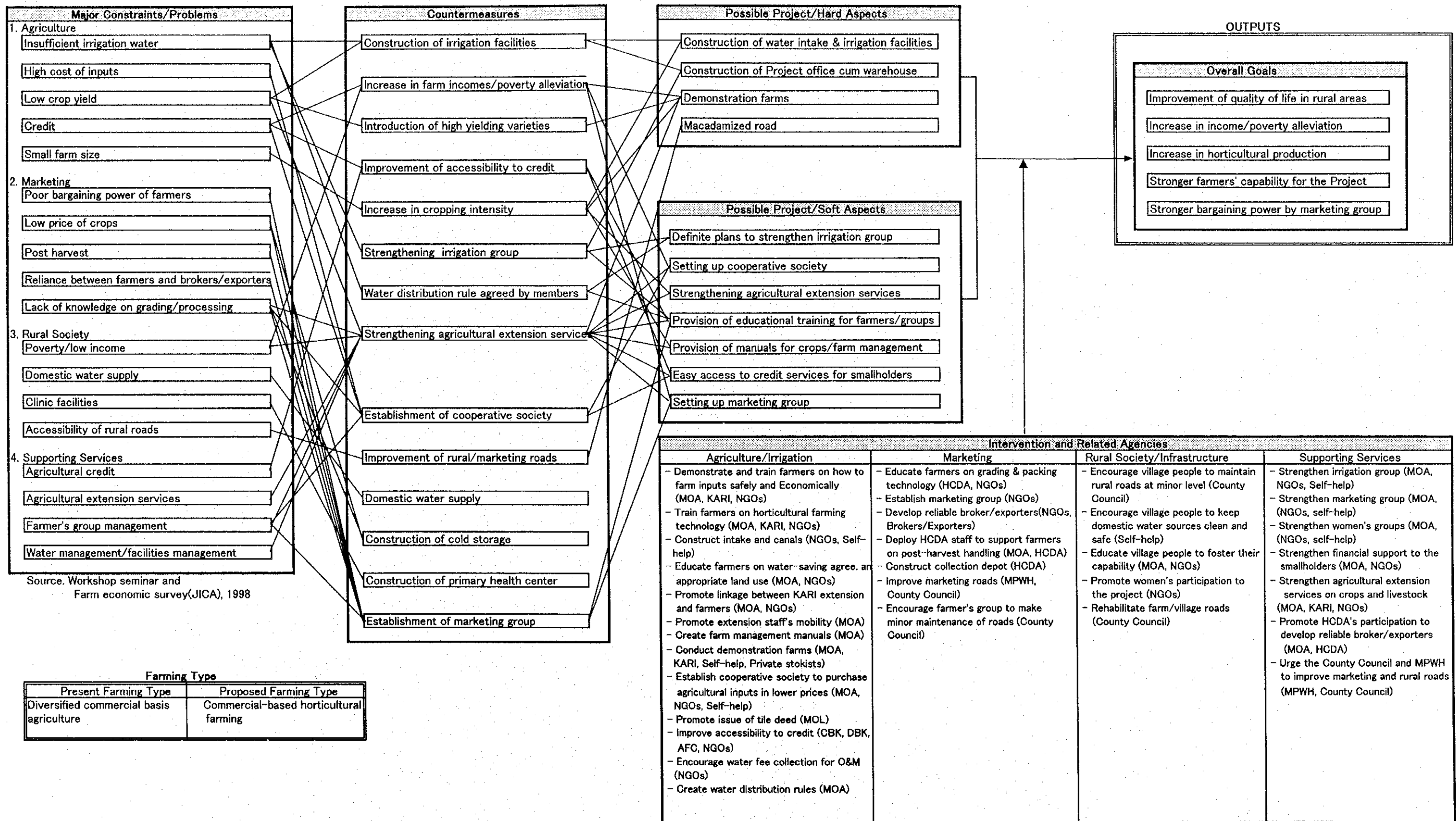


Figure 2.2-1 Relation between Hard and Soft Aspects to attain Overall Goals (Ngomano/Nyangati Water Furrow Project)

- 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 develop productive lands by improving/providing agricultural infrastructural facilities of small-scale irrigation and drainage facilities such as intake facilities and irrigation and drainage canals with related structures, and rural infrastructural facilities of 3.2 km of village/farm roads, and
- To strengthen productive activities by developing agricultural support and institution, such as the provision of necessary post-harvest facilities mainly focusing on three crops and horticultural crops, implementation of training to farmers, strengthening of extension services to farmer's groups, cooperative organization, introduction of farmer's capability building program, etc.

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 focusing mainly on tree 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) Component of the Project

The project components for the Ngomano/Nyangati Water Furrow Project are planned as follows;

- Formulation of irrigated horticultural development plan including land-use, crop selection, and development of animal husbandry
- Establishment/strengthening of farmers' organization and promotion of agricultural support services,
- Environmental considerations,
- Development of agricultural and rural infrastructures,
- Development of post-harvest and agro-industry facilities,
- Social capability building and institutional strengthening program.
- Monitoring and Evaluation of the project

2.3.2 Community Capability-Building and Institutional Development Plan

1) Community Capability-Building Plan

General Social Preparation Plan

PRA workshop for the local community will be conducted with the aim of establishing a sense of community identity and increased awareness about its strength and potential.

Capability-Building Plan for Farmers' Organization

Type of Farmers' Organization	Proposed Development Plan
Water Users' Association (WUA)	- Educate WUA members on requirements and implications of Irrigation - Facilitate the community in reviewing and updating the PDM - Train committee members on organization, general and financial management
Cooperative Society	- Indirect strengthening of cooperative society through training of WUA since the two organizations have common membership - Joint meeting of Cooperative and WUA committees to agree on implications of increased irrigated horticultural production - Promotion of linkage with WUA and Production /Marketing groups
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 labor 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

2) Development and Capability-Building of Local NGOs

To enhance the capability of the two local church NGOs in providing support services to the project community their staff will be trained in the following areas;

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

3) Tapping Services of Other Agencies in Undertaking Social Preparation

It is planned to encourage a coordinated 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

An IDB staff member will be deployed and trained on the job in PRA and PDM techniques and later attend the short PRA course at Egerton University. He will then facilitate social preparation sessions in IDB-supported irrigation schemes including the Ngomano/Nyangati scheme.

5) Strengthening of IDB Field Officers

It is proposed that staff of IDB field offices at district and divisional level will be strengthened by training them in community organization and participatory extension approaches.

6) Institutional Strengthening of District Agricultural Offices

With a view to institutionalizing contribution of specialists within the DAO's office, it is planned that follow-up support services to the irrigation project will be incorporated into their respective operational work plans.

7) Equipment and Facility Support

To facilitate the work of IDB field staff at the district level, it is proposed that they will be provided with equipment support.

8) Partnership with the Business Community

It is anticipated that partnership links will be developed between the various institutions operating at the project level and the business community as summarized below;

Project Institution	MOA	WUA	Cooperative	Marketing Group
Likely	- Horticultural Exporters	- Banks	- Banks	- Horticultural exporters
Business	- Farm input Distributors	- Credit institutions	- Input-	- Banks
Partner	- Local input stockists	- Contractors	distributors	- Local input stockists

9) Implementation of Capability-Building Training Workshops

As part of capability-building efforts, training workshops will be implemented within three years from the commencement of Project implementation.

2.3.3 Agriculture Plan

1) Policy for Proposed Agricultural Farming

The recommendation for agricultural farming for Ngomano/Nyangati Area is to produce on a commercial basis a mixture of both export and domestic vegetables, such as maize, bananas, French beans, specialty beans, tomatoes, onions, and melons.

2) Training and Demonstrations for Crop Farming and Farming Techniques

The main intervention proposed is training, trials and demonstrations focused on increasing the intensity of the current market crop production in the Area, concentrating on maximizing the output of seasonal production of cash crops, and developing some farmers as specialty producers of market crops. Some trials of promising new crops for the Area will also be conducted.

2.3.4 Water Sources Development Plan

The available water sources for the Area are run-off water from the Murubara river. The minimum amount of available water at the intake site is estimated at 0.226 cu.m/sec based on the available discharge data and authorized water permit in the immediate downstream of the intake site.

The maximum irrigation requirement for the requested irrigation area of 48 ha by the WUA is roughly estimated at 0.110 cu.m/sec without considering the cropping pattern to be introduced for the Project. As the available river water at the intake site exceeds the maximum irrigation requirement, an area of 48 ha is irrigable. Thus, it is planned that the required water for the Project will be diverted through the intake weir to be rehabilitated by the Project.

2.3.5 Irrigation and Drainage Plan

The area to be irrigated is 48 ha. The introduced crops for the Project such as maize, beans, bananas, tomato, cabbage, French beans, onion etc. are selected considering the various factors which are dominant in and around the Project Area. As irrigation methods, surface irrigation methods is adaptable from the topographical condition of the Area, and as a working time for irrigation, 12 hours operation per day and six working days per week are adopted.

The estimated maximum water requirements in the proposed cropping pattern is 69.3 lit/sec. The irrigation interval is decided at seven days considering crops to be introduced, soil texture and TRAM values.

On water management methods, two water distribution systems are proposed according to the number of rotation block to be adopted. From the viewpoint of construction costs for the irrigation facilities, open canal system with a single rotation block is proposed.

2.3.6 Institutional Development Plan for Farmers' Organizations

Type of Farmers' Organization	Development Plan
Water Users' Association	<ul style="list-style-type: none"> - Educating WUA members on irrigation implications using PRA approaches - Training management committee on financial and general management: water charges, financial accounting, planning for operation and maintenance, budget preparation, management and organization principles. - Promoting linkages with other institutions such as MOA, Department of Water Development, Cooperative Society, local NGOs as well as the private sector with a view to obtaining relevant support services.
Cooperative Society	<ul style="list-style-type: none"> - Joint workshop between the cooperative society and WUA committees aimed at exploring areas of cooperation - Training management committee in operational cost management, improved budget control procedures and elementary principles of management . - Strengthening linkages with MOA, Ministry of Cooperative Development, farm-in-put suppliers and banks
Marketing Group	<ul style="list-style-type: none"> - Promoting marketing groups and training of prospective members on registration requirements and procedures - Training of group members in financial and general management matters including produce documentation, accounting procedures, banking and management principles. - Forming linkages with WUA, MOA, HCDA, local NGOs, banks, producer buyers as well as local input suppliers.
Women's Group	<ul style="list-style-type: none"> - Organizing a workshop for existing women groups where members will identify women concerns, needs and priorities - Facilitating review of the proposed irrigation project from women perspective and identify opportunities for women-specific benefits - Training women groups in financial record keeping, planning, banking, as well as well as general management principles. - Encouraging linkages with MOA, HCDA, local NGOs, produce buyers, input suppliers as well as banks.
Other Groups	<ul style="list-style-type: none"> - Encouraging them to upgrade into production/marketing groups

2.3.7 Institutional Supporting System Development Plan

Staff of various agencies will be trained with the aim of enhancing their ability to strengthen farmers' organizations. Such training will include: community organization, participatory approaches, management and organization principles.

2.3.8 Marketing Plan

In order to improve the marketing situation in the Area, the following interventions and activities are proposed through the careful analysis of present problems in marketing aspects.

Proposed Interventions and Activities for Marketing Plan

Problems/Constraints	Interventions/Activities	Agency/Operation Body Concerned	Outputs
[1] Middlemen causing lower prices of our produce	- Seminar on auction consignment at JKUAT and other institutions managed by the government	- Marketing expert of HCDA-HQ	- Introduction of auction consignment with HCDA - Organizing small scale marketing groups
[2] Exploitation of farm produce by exporters	- Provision of market price information from Nairobi Horticultural Center (auction results) for export produce	- Marketing expert of HCDA-Mwea	- Attaining auction market information - Better crop planning
[1&2-1] Poor marketing arrangements	- Provision of market price information at Wanguru market and collection at Kutus wholesale market for local consumed produce - Group loading and transport arrangement for local consumed produce - Seminar on varieties and certified seeds procurement at JKUAT and other institutions managed by the government - Collection of certified seed information	- Mwea divisional extension officer at Wanguru - Member farmers for Kutus - Marketing groups - KARI - Farm inputs/ marketing officer of DAO-Kirinyaga - Marketing expert of HCDA-Mwea or Karatina	- Better crop planning - Reducing post-harvest losses - Increasing bargaining power - Creating options of market alternatives to Kutus, Wanguru or traders - Better yields and plant protection - Assurance of germination rate
[3] Long distance to selling points	Comparing with other Project Areas, this Project Area is not far from the markets.		
[4] Poor access roads			
[5] Poor storage for products	- Participation to auction utilizing the facility of pre-cooling	- Mwea Satellite Depot of HCDA	- Extending shelf life and better prices for export produce
[5-1] Lack of electricity			
Lack of knowledge on requirements on export produce	- Seminar on maximum residue levels (MRLs), crop assurance and grading using Export Crop Bulletin at JKUAT and other institutions managed by the government - Seminar on trend in foreign markets	- Marketing expert of HCDA - Representative of exporters or FPEAK staff	- Attaining information for export of chili, okra, etc., crop assurance and grading - Increasing materials for decision-making in selection of crop
Lack of marketing organization	- Seminar on marketing organization through PCM workshop at JKUAT and other institutions managed by the government	- MOA staff on farmers' organization	- Organizing small scale marketing groups with support of women groups and youth groups
High losses by bad weather conditions	- Weather forecasting	- Kenya broadcasting (KBC) - DAO-Kirinyaga	- Crop planning to select fluctuated produce such as green maize, beans, green gram, carrot, kale, fresh peas when expecting drought
Lack of knowledge on consumers' or buyers' demands	- Field trip pursuing marketing routes; Nairobi markets, exporters' grading & packing facilities, Nairobi Horticultural Center	- MOA staff	- Better understanding of consumers' or buyers' demands and how to handle produce

2.3.9 Physical Plan and Cost Estimate

For irrigation system improvement, based on the construction of a permanent intake weir for reliable irrigation water intake, alternative study on water conveyance system was made from the viewpoint of irrigation rotation system. As a result of the study, irrigation rotation under which whole areas as one rotation block are divided into six application blocks is recommended. The improved irrigation system includes division boxes to improve water distribution management and drop structures to reduce canal erosion. Construction of drainage canals is also proposed in the lower part of the Project Area.

As for rural roads, rehabilitation of 3.2 km of village/farm roads is planned employing the spot improvement method.

Project costs consist of two categories, i.e. construction costs, and community development and support services costs. Total project costs are estimated at 33.4 million Ksh, of which 4.6 million Ksh will be the repayment costs by beneficial farmers. Annual operation and maintenance (O&M) costs for facilities are 228 thousand Ksh.

2.3.10 Project Implementation and Operation and Maintenance Plan

1) Overall Project Implementation Plan

An Executive Steering Committee (ESC) under the chairmanship of the Permanent Secretary of MOA and a Technical Working Committee (TWC) shall be established for smooth implementation of the project. Moreover, under TWC, the District Project Management Office (DPMO) shall also be organized at the district level.

Project implementation is classified into two categories, i.e. facility construction, and community development and support services. Implementation of community development and support services including social preparation and institutional strengthening shall be carried out by suitable agencies such as consultants and NGOs. Facility construction shall be implemented through labor-intensive methods on a contract basis with local contractors under the supervision of DPMO. Self-help projects such as irrigation improvement whose costs are borne by WUA under the cost recovery concept are supervised by NGOs. On the other hand, public projects such as road improvements to be financed by the government are carried out by Consultants under the direction of District Road Engineer (DRE). Community initiative in the implementation shall always be considered particularly for the self-help projects.

The total implementation period is assumed to be seven years in consideration of social preparation and fund procurement for self-help projects as critical factors on implementation.

Executing agencies/bodies for the operation and maintenance of facilities are MPWH for access roads, Ngomano/Nyangati Water Furrow Association for irrigation facilities and village communities for village/farm roads.

2) Capability-Building Implementation Plan

Capability build-up during project implementation will be given by various agencies as shown below;

Project Stage	Agency	Type of Capability-Build-up Service
1. Project Planning	a) MOA/IDB	- Social preparation of project community - Facilitation of WUA planning sessions (activities, subactivities)
	b) MOA/DAO	- Acting as resource persons during social preparation sessions
	c) Local NGOs	- Acting as resource persons during social preparation sessions
2. Project Design	a) MOA/IDB	- Facilitating WUA design review sessions (availing design model, explaining design criteria and expected mode of operation of design elements) - Actively seeking women's input into the design
	b) MWR	- Awarding and securing water rights for WUA
	c) Local NGOs	- Acting as resource persons
3. Project Funding	a) MOA/IDB	- Advising on project costing and alternative sources of project funding - Explaining funding conditions and procedures for various funding agencies
	b) Local NGOs	- Training WUA members on group formation for security fund contributions, banking operations, loan funds & loan servicing procedures
	c) MOCSS	- Assisting farmers on harambee organization
	d) Provincial Administration	- Facilitating harambee organization by issuing licenses
4. Project Construction	a) MOA/IDB	- Advising WUA on criteria for tender assessment and contractor selection, required supervision and quality control aspects of construction activities
	b) Local NGOs	- Training WUA committee on contractor payment procedures
5. Project (O&M)	a) MOA/IDB	- Facilitating and acting as resource persons during O&M sessions
	b) MOA/DAO	- Acting as resource persons during O&M sessions

Related agencies for providing support services after Project implementation are as follows:

Agency	Type of Support Services
KARI	- On-farm horticultural research aimed at solving problems relating to low crop yields, crop pests and diseases and lack of appropriate crop introductions.
MOA	- Planning, executing and monitoring extension services and paying special attention to production/market groups as well as women's groups - Facilitating a one-day annual review of irrigation project performance by farmers and other stakeholders. - Strengthening artisan and entrepreneurial skills that will be needed during the operation and maintenance phase. - Fostering farmers' capability by awarding prizes every year to the best three irrigated horticultural farmers within the project
Local NGOs	- Giving support in planning courses of action on other problems facing the community.

2.3.11 Environmental Management Plan

The extension service and farmers' training by MOA shall include the risk, and appropriate use of agrochemical and promotion of improved cooking stoves for women's groups.

Sanitary education for children at primary school is required to protect against intestinal worms and diarrhea. Water quality analysis of the sources of drinking water is required periodically and the result shall be informed to the inhabitants, so that they can learn which water source is more safety.

2.4 Project Evaluation and Cost Recovery

2.4.1 Economic Evaluation

Project was evaluated from the national economic point of view by using EIRR as an index. EIRR of Ngomano/Nyangati Project is estimated at 22.1 percent which is higher than national standardized EIRR of eight percent for agricultural project. Therefore it can be stated that Ngomano/Nyangati Project is economically feasible. If including the mapping costs, which are not included in the project costs because JICA Study Team made it, EIRR is 21.5 percent.

2.4.2 Financial Analysis

Financial analysis for the typical farms was made to compare their farm economy in case of with-project and without-project. Farm income including animal income and off-farm income will increase when compared with without-project cases. Farm income in this Area is estimated as follows;

- Without Project : 84,846 (Ksh/farm/year)
- With Project : 187,359

2.4.3 Cost Recovery

Amortizing conditions for the small-scale irrigation projects in this Area should be decided based on the results of the financial analysis, rather than based on the present loan conditions. Therefore, cost recovery was studied to justify farmer's ability to repay by changing credit conditions such as interest and repayment period, and monthly repayments in each case was calculated and then compared with the estimated disposable incomes which were calculated in the financial analysis. Amount of monthly repayment based on the current and recommended loan conditions is shown below;

- | | <u>Excluding Mapping
Costs</u> | <u>Including Mapping
Costs</u> |
|---|------------------------------------|------------------------------------|
| - Monthly repayment under current loan conditions | :1,075(Ksh/farm/month) | 1,169(Ksh/farm/month) |
| - Monthly repayment under proposed loan condition | : 742 | 807 |

2.5 Recommendations

Agriculture

- a) Current dominant farming type of the Ngomano/Nyangati Water Furrow Project, which was classified as Type-C in Model Area selection, is the diversified commercial basis type of consumption-oriented agriculture, and beneficial farmers have such strong willingness that present farming type should be shifted to commercial-based horticultural farming. Therefore, plan of agricultural farming in the Area should be formulated in the direction mentioned above.
- b) The trials and demonstrations will be conducted by the GOK staff in Agricultural Extension and Irrigation Development Department. The recipients will be the smallholders. The trials and demonstrations will be conducted on farmer's fields. The actual timing will be determined by the nature of the trial, and preparations will have to be made in advance of the planting season. The frequency will be as shown below. The method will be in collaboration between individual farmers and the project.

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Demonstrations	4	4	2	2	1	13
Trials	2	2	2	1	1	8

- c) The training programs on crop cultivation will be conducted by GOK staff and hired professionals from private sectors. They will be given to interested farmers, and will be held in the field near to the irrigation scheme, in churches, meeting halls etc. for the periods of approximately every six months for the first two to two and a half years. These training programs will be linked to the trials and demonstrations farms.

The programs will include topics such as selection of new varieties (e.g. maize hybrids) and how their production differs from traditional varieties, water management and irrigation techniques, animal nutrition including the use of urea supplement blocks, etc.

d) Others

- Assistance to farmers in leveling their farmland,
- Test of impact of deep plowing on plant growth,
- Encouragement of new banana planting
- Assist farmers to become off-season special pulse producers
- Provision of access to improved breeds of free-range chicken
- Training of tomato farmers in production schedule

Institutional Support Services

- a) The District Irrigation Unit at Kerugoya liaise with IDB, Nairobi in drawing up a training program specifying the Ngomano/Nyangati Water Furrow Project for social preparation of the community and capability building of relevant agencies such as Department of Social Services and local private sectors.

- b) DPMO should draw a training timetable for social preparation and capability building of relevant agencies.

Irrigation and Drainage

- a) The total farmland in the Project Area is 381 ha, of which 142 ha are located in the south-west part of the Project Area and is presently irrigated by using spring and drained water from the higher land. Therefore, the proposed irrigation area of 48 ha shall be selected from the farmlands which are situated in the at north-west and east part of the Project Area within the 142 ha.
- b) Considering that the proposed irrigation area of 48 ha spreads over the total farmland of 142 ha along the existing open canal with a length of 8.1 km, and irrigation water is diverted directly from main and/or lateral canal directly through temporary notch, it is recommended to introduce a water management plan with single rotation block with six irrigation groups. The WUA shall decide the area and location of proposed farmland to determine design capacity of irrigation canal before the commencement of detailed design study.
- c) In order to realize effective water management, a water management manual shall be prepared by the employed consultants. As to the content of the manual, the following items as well as general techniques of water management shall be included, and training to members of the WUA shall be provided before the commencement of actual irrigation works.
- Adaptive organization for water management (general water management method for total system, organization of irrigation group)
 - Water operation rule (method of water distribution, observance of standard cropping pattern, formulation of penalty)
 - Water distribution method within the irrigation group (irrigation turn, irrigable area)
 - Irrigation method (furrow length, water application time per unit area)
 - Irrigation schedule
- d) It is recommended to obtain a water permit from the MWR.

Marketing

- a) Discussion and formulation of farmers' marketing groups including women and youth groups,
- b) Auction participation in connection with Mwea Satellite Depot for export produce as a marketing alternative,
- c) Practical utilization on social and natural resources for marketing advantages of; i) various marketing alternatives, ii) geographical advantage, iii) large trading volume at Kutus wholesale market, iv) increase of population of Wanguru town, v) active women's groups, vi) near distance to Mwea satellite depot,
- d) Participation to related seminars for smallholders held at Jomo Kenyatta University of Agriculture and Technology (JKUAT) and other institutions managed by the government,

Agricultural and Social Infrastructure

- a) Basic plan for the irrigation improvement shall be finalized based on feasibility study result through workshop meetings to be held with association members before commencement of the detailed design.
- b) Geological investigation shall be required at the intake weir site at the detailed design stage.

Project Implementation

- a) Main implementation agency of the Project is MOA, however, close cooperation and adjustment of work demarcation should be made among related government agencies such as MPWH, MWR, MEC, etc., since the Project involves many project components being related to each other.
- b) For the construction work of the self-help projects, detailed work allocation and responsibilities as indicated below among Contractors, WUA and NGOs, which are directly related to the construction costs, shall be clearly presented to WUA in the detailed design stage;
 - Contents of work to be contributed by WUA in the form of labor,
 - Responsibility of procurement and management of materials, equipment and skilled labors, and
 - Responsibility of work quality and schedule.
- c) In the courses of project implementation, farmers/farmers representatives should make reference to the on-going activities of classified Type-A smallholder irrigation schemes such as Ciambarage Irrigation Scheme in Tharaka Nithi and Muguna Water Project in Meru district for their horticultural development.
- d) For the planning of irrigated horticultural development for each Model Area, the Study Team prepared a topographical maps with scale of 1:5,000 applying aerial photography and ground survey methods at costs of about 669 thousand Ksh per site (average size is 276 ha). These topographical maps are deemed to be essential and useful not only for carrying out physical planning of irrigation and drainage facilities in the Area, but also encouragement of farmers' participation in the project with their awareness of common ownership of community resources.

In the project evaluation, the required costs for preparation of the topographical map mentioned above were not counted because of Study Team's cost burden. However, when other projects are planned, a topographical map with a scale of 1:5,000 should be prepared and the required costs should be shouldered by the beneficiary group themselves.

Environment

- a) Concerning agro-chemical use, it is important to refrain from agro-chemical use in preventing pest and disease by use of proper crop husbandry practices, such as crop rotation, inter-cropping and improvement of soil fertility should be employed.

- b) MOA should support horticulture as well as livestock-raising, production of feed and manure synthetically. Extension officers of MOA should improve the know-how of agriculture and livestock-raising. Further, It is important to approach the plan in combination with other projects executed or being executed by other donors.

Project Economy and Farm Budget

- a) It is recommended for the preparation of detailed project plans of the proposed small-scale irrigation schemes that MOA should undertake careful appraisal to examine project plans to be proposed by the community's concerned, placing emphasis on the appropriateness of the technology designed for irrigation systems and the accuracy of the cost estimate to be based on least-cost approaches.

In almost all the small-scale irrigation projects, many farmers are being confronted with difficulty in repaying of loans. This holds true even for the farmers of Ciambaraga Irrigation Schemes in Tharaka Nithi district, one of the well-managed projects among the 463 reviewed. Accurate cost estimates are important, since the cost is a crucial element in determining the financial and economic viability of the project and also for planning its funding.

- b) It is recommended that prior to the implementation of the projects, a farm budget analysis of the representative farms should be conducted, through detailed farm surveys, with the primary objective of providing a basis for an assessment of the investment plans and debt repayment capacities of the farmers.

The farm budget analysis also provides a basis for setting repayment terms and conditions for credit that will be enough to encourage the farmers to participate in the project and make sure that they will have sufficient cash to repay the loans. The ability of the farmers to pay is an instrument for promoting sustainability.

- c) It is recommended that intensive backing should be given to the farmers participating in the project until they have attained the full production target, since it may take several years to reach this target. To this end, the district government should establish the District Project Management Office (DPMO), responsible for providing support services to the farmers, as proposed in this study.

The proposed DPMO shall formulate support services programs in close coordination with HCDA, FPEAK, DAO and NGOs as agricultural development could be realized only with the full cooperation of the agricultural services agencies, as well as the cooperation of the private entities concerned.

Monitoring of the Project

- a) Monitoring work for project implementation works should be carried out by external agencies under the supervision of Executive Steering Committee (ECS), to cope with the following objectives;

- To obtain and judge how many goals and targets initially formulated under the Project are attained,
- To judge whether or not follow-up support is required from the viewpoint of project sustainability under self-help management, and
- To learn lessons, both positive and negative, from the Project in order to apply to other project areas for improvement .

b) Monitoring shall be conducted on the following items;

- Irrigation system operation
- Access and village/farm roads maintenance
- Agricultural aspect
- Institutional aspect
- Marketing aspect
- Farm economy aspect
- Control of soil erosion and watershed management

Table 2.5-1 indicates the required training items for the implementation of smallholder irrigation schemes in Ngomano/Nyangati Water Furrow Project

Table 2.5-1 Required Training Items for Ngomano/Nyangati Water Furrow Project

	Training Items	Farmers/ Farmers' Group	Implementing Staff
1. Agriculture/Irrigation	- Land use mainly for horticultural crops	•	•
	- Irrigated and rainfed crop farming for both horticulture and food crops	•	
	- Establishment of cooperative society to purchasing agricultural inputs	•	
	- Application of farm input	•	
	- Water saving farming	•	
	- Water management in open canal system	•	
	- Drainage improvement in the lower flat area	•	
	- O&M works for irrigation facilities in a flat area	•	
	- Management of trial and demonstration farms	•	•
	- Monitoring of the project		•
	- Development of farm and water management manuals		•
	- Maximum residue levels (MRLs) and crop assurance for export crops	•	•
2. Marketing	- Establishment/strengthening of marketing group	•	•
	- Marketing techniques for both horticulture and food crops to brokers/exporters	•	
	- Promotion of contract farming	•	•
	- Collection/compilation of market information	•	•
3. Rural Society/Infrastructure	- Capability-building for farmers/farmers' group and implementing staff	•	•
	- Promotion of women's participation to the project	•	
	- O&M for water source facilities for rural water supply	•	
	- Construction and O&M of village and farm roads	•	
4. Support Services	- WUAs' roles and performance	•	
	- Financial management for cooperative societies	•	
	- Access to agricultural credit	•	•
	- Linkages with other institution		•
5. Environment	- Soil erosion control at sloping farms	•	•
	- Watershed Management and water conservation	•	•
	- Promotion of improved cooking stove	•	