

2.7 Recommendations

Agriculture

- a) Current dominant type of the Ngomano/Nyangati Water Furrow Project, which was classified as Type-C in Model Area selection, is the diversified commercial basis 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 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 farm. 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 should liaise with IDB, Nairobi in drawing up a training programme specifying to 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) Project Coordinator (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 380 ha, of which 142 ha are located in the south-west 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 north-west and east part of the Project Area.
- 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 employing consultants. As content of the manual, the following items as well as general techniques of water management shall be included, and the training to the 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.

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 advance, iii) large trading volume at Kutus wholesale market. iv) increase of population of Wanguru town, v) active women's groups, vi) close 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 cost, shall be clearly presented to WUA in the detailed design stage;
 - Contents of work to be contributed by WUA in the form of labour,
 - Responsibility of procurement and management of materials, equipment and skilled labours, 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 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. Its costs were 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 maps mentioned above were not counted because the Study Team shouldered the costs. However, when other projects are planned, such topographical maps 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.
- 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 till 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.

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.

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

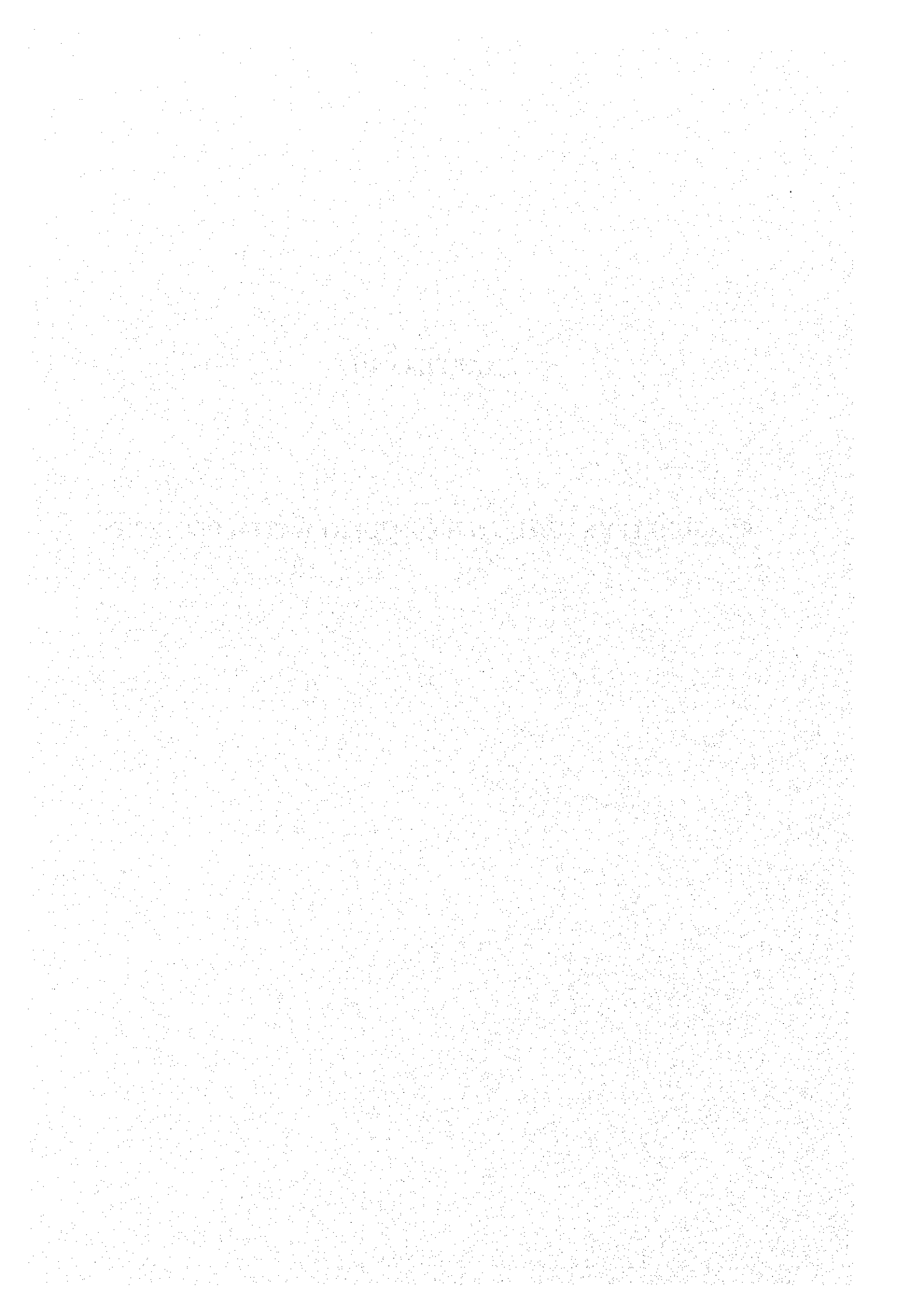
Table 2.7-1 indicated the required training items for the implementation of smallholder irrigation schemes in Ngomano/Nyangati Water Furrow Project.

Table 2.7-1 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	•	•	

CHAPTER III.

FEASIBILITY STUDY ON NKUNJUMO WATER PROJECT



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CHAPTER III. FEASIBILITY STUDY OF NKUNJUMO WATER PROJECT

3.1 Present Situation of the Area

3.1.1 Introduction

Nkunjumo Water Project is Type-D Model Area. This Area is the proposed irrigation scheme, and categorized into the moderate to severe area with relatively easy accessibility to Area from all weather roads (2.0-7.0 km), high construction cost per hectare (13,200-266,700 Ksh/ha), and relatively low percentage of horticultural cropping area (more than 70 %).

3.1.2 Physical Condition

1) Location, Meteorological and Hydrological Conditions

Nkunjumo Water Project is situated in Gatimbi location, Ab-Central division of Meru district, Eastern province. It is about eight kilometer south from Meru town. The scheme extends 2.7 km along the right bank of the river and ranges between 0.3-0.5 km wide. The gross farm land area of scheme is 160 ha.

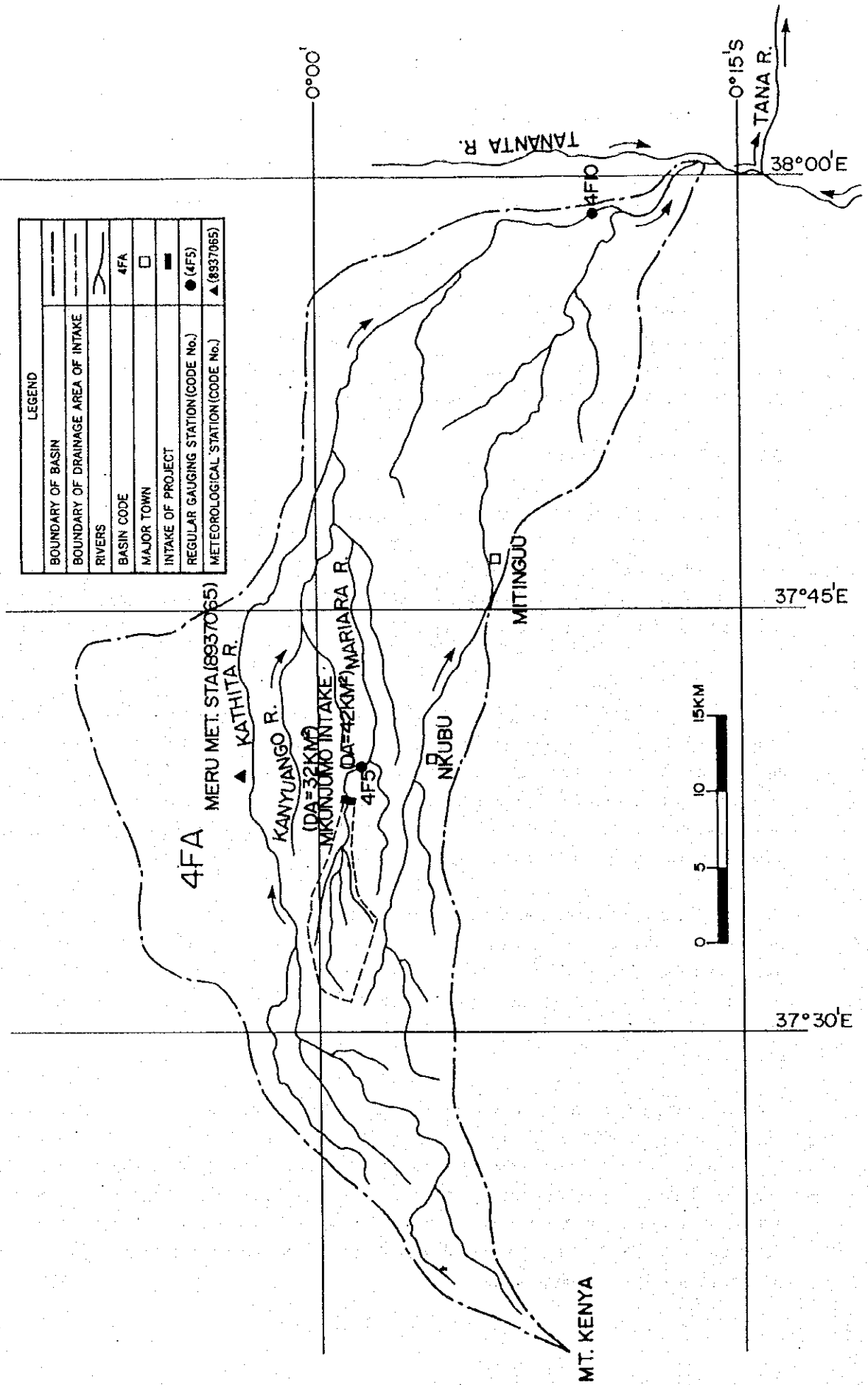
The scheme lies in Upper Midland Agro-Ecological zone, the Coffee zone. The rainfall, evaporation and temperature are more than adequate. The mean annual rainfall with the long rains coming from October to January and the short rains from March to May is about 1,260 mm against the annual evaporation of 1,460 mm, and the mean temperature ranges from a daily minimum of 11.4°C in January to a daily maximum of 25.7°C in March. The details of the data observed at Meru Meteorological Station which is nearest one from the Project Area are shown in Table G.2.3-1 in Annex G.2.

The irrigation water source is the Mariara river which is a tributary of the Kathita river and one of major rivers in Meru district. The catchment area above the intake site is only 32 sq.km., but because it is located in the Mount Kenya Forest with high rainfall, river water is available year round. The location of meteo-hydrological stations near the Project Area and the intake of project is shown in Figure 3.1-1.

2) Topography

Nkunjumo Water Project is in the ridge and valley region, part of the north-eastern foothills of Mount Kenya. Elevation of the Project Area is between 1,460 m to 1,600 m, on the south bank of the Mariara river. The existing concrete intake structure is located on the upstream portion of the river in a steep sided valley. A pipeline distributes the water from the intake to the top of an adjacent main ridge and then downstream to a number of smaller ridges. The ridges are moderately high and steep sided, with slopes ranging 0 - 25 percent. But particularly at the head of the project are flat topped on their summits, and this is where the irrigation areas are located.

Figure 3.1-1 Location of Metro-Hydrological Station and Project Intake of Nkunjumo Water Project



3) Soil and Land Use

The Project Area soils are deep clay loams derived from the olivine rich basalt volcanic flows of Mount Kenya. The undulating dissected footridges of the area are covered with ando-humic Nitosols. These Nitosols are well drained, extremely deep, dusky red to dark reddish brown, friable clays and clay loams with an acid, humic topsoil. At this elevation, the higher rainfall combines with the good water storage capacity of these Nitosols to make coffee production predictable. Soil samples were taken and the soil profiles described (see Annex H).

Much of the farm land on the sides of the main ridge has been terraced and planted to perennials (coffee on the slopes, bananas along the river valley bottoms). The farm plots run from one river valley to the other, up, over and down the ridge. The proposed irrigable area is 56 ha. Currently 16 ha are being sprinkler irrigated from the existing drinking water supply project. The irrigated crops grown are vegetables such as cabbage, potato, kale, french beans, sweet potato, onion etc. Coffee, the main cash crop, dominates the area. The main annual crops are maize and beans. Stands of bananas are common, especially around the house and along the riverside. Napier and kikuyu grass for the dairy cows is grown on the edges of the coffee terrace, the road sides and in small plots. The zero grazed cattle are also fed with banana stalks.

3.1.3 Administration, Socio and Farm Economic Conditions

1) Administration and Rural Organization

The administration and rural organization of the Project Area may be described within the context of the standard Kenyan administrative units as shown below:

Administration of Project Area

Province	District	Division	Location	Sub-Location
Eastern	Meru Central (Old Meru)	Abothoguchi Central	Gatimbi	Ngerwe

Administration of the Project Area, including provision of government support services, is structured along the last four administrative units.

At the district head-quarters, are located the heads of government ministries and departments which include the district commissioner, district agricultural officer, district medical officer of health, district water engineer etc. In turn, these ministries and departments are represented at lower administrative units from the division level down to the sub-location level.

The political leadership pattern also generally follows the existing administrative framework. For instance, the member of parliament (national legislative organ) represents a constituency whose boundary approximately coincides with that of the division administrative unit. Similarly, the councilor

who represents the local community in the district county council (local government) is elected from an area which is almost the same as the location administrative unit.

The district commissioner, who is the head of the "provincial administration," acts as the co-ordinator of all government supported development activities in the rural areas. He is also the chairman of the District Development Committee, the body responsible for reviewing major development projects whether promoted by government, NGOs or the private sector so long as such projects have an impact on the public at large. The authority of the provincial administration is projected downwards by the district officer at the divisional level, by the chief at the location level and the sub/assistant chief at the sub-location level.

2) Ethnic Group

People living mainly on coffee farming in Nkunjumo district which belongs to coffee zone is Meru ethnic group. They inhabit at the north-eastern foothills of Mt. Kenya. They are about a million and accounts for about five percent of Kenyan population. Men are administrators of their family's property and have the decisive power in the Meru society. Though lands are family's property, they are administered by the head of family, that is to say old men. While women don't have a right to possess a land, they can utilize it.

3) Population and Farm Household

As there aren't reliable statistics for this area, selected farmers were interviewed using prepared form to get information and detail data on agriculture and socio-economy by the Study Team in Nkunjumo Area. The results of analysis of the present conditions becomes the basis in formulating various plans.

The number of the farm households in the Area is about 300, and 140 of them are members of the existing irrigation group. Population is estimated at 2,200 based on the averaged family size of 7.4. The ratio of women's population is 49.8 percent.

4) Farm Economy and Living Conditions

a) Farm Size and Self-Sufficiency of Food

The area partly irrigated is 16 ha at present. Averaged farm size per farm household is 1.10 ha according to the result of the farm economic survey. It is about a quarter of the average farm size of 3.97 ha in Meru district. As mentioned above, major crop in this area is coffee, and they have coffee cooperatives. There aren't marketing group for other crops. The ratio of farmers who have a title deed account for 55 percent, and that is the second highest ratio next to Rupingazi Ngerwe Area among the four Project Areas.

Some 75 percent of the farms interviewed in the farm economic survey don't meet demand for maize for family consumption on their own farms. It rate is the second highest following that of the Ruungu/Karocho area. Though farmers answered that is because of small farm size, land use concentrated to coffee is considered as another important reason. The shortage of maize is supplemented by buying from local market.

b) Farm Household Income

Averaged annual household income is estimated at 46,200 Ksh, composing of 30,400 Ksh of crop income, which is the major source of income, 3,200 Ksh of animal income and 12,600 Ksh of off-farm income, which accounts for 27 percent of the total income. The amount of off-farm income is the second largest following Ngomano/Nyangati Area. Since averaged farm household income in Meru district is 111,840 Ksh, family income in this area is no more than 40 percent of it. Coffee in this Area has low productivity and low quality in general. Together with the small farm size, these seriously effect on farm household income.

c) Farm Labour Available

Average family has 7.4 members, 4.9 of which are farm labours available, though full-time farm labour is 2.0 in a family. The rate of female agricultural labour forms 50.8 percent.

d) Living Standard Compared with Poverty Line

Averaged annual farm household income in the Area is estimated at 46,200 Ksh based on the farm economic survey, corresponding to 6,243 Ksh per capita per year based on average family size of 7.4. The poverty line in rural area in Kenyan is estimated at 8,440 Ksh per capita per year. As compared with the both, annual income per person in the Area is lower than the poverty line.

e) Educational Status

The educational status of the head of farmer's family in Nkunjumo Area is considered not so high. The rates of person graduated from elementary school, junior high school are 22.5 percent and 17.5 percent, respectively, which are the highest rate among the four Project Areas. Therefore, careful attention should be paid when providing various supporting services after the implementation of the project.

f) Bylaw of the WUA

The bylaw in Nkunjumo irrigation Area was drawn up in 1977, and was amended in 1980. In the amendment, both membership and entrance fee were increased according to the change of economic condition. The bylaw mentions the duty for mutual works and the penalty to illegal water use, but it does not mention on water distribution.

5) Conditions of Social Capability

a) Present Conditions of Social Capability

People within the Project Area have been settled for a long time and have therefore formed a strong community identity and stable neighborhood relationships. The traditional practices of mutual help are active and have been applied to non-traditional projects.

Such non-traditional projects include:

- Co-operative society for collective processing and marketing of coffee
- Installation of cattle dip for controlling tick-borne diseases among livestock
- Construction of schools, polytechnics and churches

The community places a considerable weight to educating its children and sees the proposed irrigation project as contributing to this realization. Presently, most of the land has been taken up by the cash crop and coffee, and a majority of households have to purchase food from outside. In this regard, irrigation is expected to improve food self-sufficiency at the household level.

b) Assessment and Consideration of Present Conditions of Social Capability

During the field workshop, women and youth were observed to sit separately and were not very forthcoming in their contributions. It is the older men who dominated discussions. It was also learnt that the committee consists of old men with no youth or women representation. The community needs, therefore, to face the challenge of integrating women and youth in the proposed irrigation project so that the potential of all the members of the Project Area can be utilized.

3.1.4 Agricultural Conditions

1) Crop Production

Based on the results of the field survey and the farm economic survey conducted by the Study Team, the total gross cropped area per year in Nkunjumo is estimated at 202 ha.

Estimate of Present Crop Production

Crop	Area Rainfed	Area Irrigated	Yield Rainfed	Yield Irrigated	(unit : ha)	
					Production Rainfed (ton)	Production Irrigated (ton)
Maize/beans	62	0	1.75	2	109	0
Beans/maize	62	0	0.3	0.45	19	0
Green maize	0	1	0	3	0	2
Beans	33	0	0.6	-	20	0
Coffee	69	0	4.5	-	313	0
Banana	9	0	8.5	-	78	0
Potato	7	2	7.5	8.5	53	14
Cabbage	3	1	10	14	35	8
Kale	3	1	6	8	18	12
Fr. Beans	2	1	3	3.5	7	5
Tomato	2	0.9	7.5	8.5	14	8
Napier	0	1.6	-	13	-	22
Millet	1.4	0	0.8	-	1	0
Onion	0.2	0.8	6.5	7	1	5
Total	193	9				

Source: Farm Economic Survey and Phase-III field work

The current cropping intensity is about 126 percent of the gross area. The average farm size is around 1.1 ha. The potential excess evaporation over rainfall is only about 200 mm, and the temperatures are temperate. The rainfall and soils in this area are more than adequate. Nkunjumo area is one of the two wettest of the four Project Areas, with the main restrictions on crop growth being cloudiness and occasional cooler night temperatures. The main cash crop is coffee. The main food crop, maize, is grown interplanted with beans. The existing drinking water supply system is used to grow small areas of a range of vegetables. The fruit trees found include an occasional avocado in the coffee, guava, paw-paw and macademia near the house.

2) Farming Practices and Input Supply

Much of the land around the proposed irrigation area is well kept terraced coffee. In July, the main farm activity is pruning coffee (multiple leaders), then clean cultivating under the bushes and manuring with cow manure from the zero grazing. Near the houses and along the edge of the river bananas are found. Especially near the house, sweet potato is often planted under the banana. Land preparation is done with a jembe, and maize with or without beans is planted in the flat open areas near the houses. The main vegetable crops grown are green maize, potato, cabbage and kale. Occasional plots of French bean, and onion are found. The *Grevillea* found scattered throughout the Project Area especially along the field boundaries, are often interplanted with yam.

Manure for the coffee and the vegetables is available from the zero grazed cattle. Seed and other inputs are available in the nearby large towns of Meru and Nkubu. Vegetable seed is usually acquired there. Fertilizer and pesticides are being used, on both the coffee and the vegetables. Access to government extension staff and services is comparatively easy from the Project Area.

3) Animal Husbandry

Dairy cattle are corral fed near the house with banana leaves and stalks, plus field waste. Occasional sheep and goats are tethered on the waste land. Napier grass is planted on the roadsides and other un-used areas, and together with kikuyu grass is found along the edges of the bench terraces. Children are responsible for collecting forage for the animals, and removing manure. Women do the milking. The cattle are mainly improved breeds or crosses. Most farms have a few local hens around the house.

3.1.5 Marketing of Agricultural Product

1) Crops for Local and Export Markets

The crops for cash earning are mainly coffee cherry, macademia, French bean and limited volume of local consumed vegetables in this Project Area.

Coffee

Normally, the coffee cherries at Nkunjomo are evaluated as T class, which is a slightly lower level out of 14 grades. The coffee cherry prices at farm gate are directly influenced by international price at New York market. The prices had been fluctuating at more than five times in 1990's; 56.18 US\$ per lb in September, 1992 and 318.50 US\$ per lb in May, 1997 according to Coffee Statistics 1997, International Coffee Organisation. This huge fluctuation strikes farmers' incomes, though Coffee Board of Kenya take a few risks by postponement of auction but it is possible to bear only for three to six months. In lower prices year, farmers can not repay even costs of inputs to coffee societies. The fluctuation of international price seems to intervene 5-7 years, thus there is possibility that the coffee prices in 1998/99 coffee year will drop again. In fact, the chairman of Kenya Planters Cooperative Union predicted drop of the prices soon due to high production in Brazil. The farmers in Project Area are actually seeking for the feasible means of horticultural production for diversification from the monopoly. Farmers also understand that extremely dependent upon coffee production can not secure their livelihoods especially to feed families and for payment of school fees and medical costs.

Macadamia Nut

The second source of cash income is shelled macadamia nuts. The crop can be stored about 10 days and the prices are stable at 30-35Ksh/kg. Its post-harvest losses caused by transport are relatively lower. The harvest season is concentrated in April to June. For the export to Japan from Kenya, this produce was ranked at third position at 3.4 million US\$ or 10.8 percent of total export amounts following freezing fish (26.4%) and coffee (16.4%) according to 1997 White Paper of Ministry of International Trade and Industry of Japan. The production of this crop is still recommendable if the exchange rate of Kenya Shillings against US\$ will not increase.

French Bean

Farmers sell individually to one of four middlemen at 20-30Ksh/kg. The prevailing prices in Meru District are collected by Farm Inputs /Marketing Officer of DAO and as follows:

Prevailing Price in Meru District and FOB Prices Comparison of French Beans in 1997

Crop/Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
French Bean												
Volume(carton)	17,530	46,300	51,550	67,259	45,717	14,684	11,868	24,668	24,668	48,178	36,109	16,021
Price(Ksh/cart.)	60	70	75	65	60	85	70	70	70	70	70	70
FOB Price at JKIA (Fine bean prices converted to carton basis)												
Price(Ksh/cart.)	300	288	213	270	426	423	402	288	426	540	321	276

Note : One carton is about 3 kg contents, and the prices are excluded from the rejected produce.

Source : Annual report 1997 marketing/ farm inputs, DAO of Meru, 1998 and Export produce statistics (draft), HCDA, 1998

The prices at farm gate are not reflected to the actual trading prices between exporter and importers, and the costs including middlemen charges, transporting costs, exporters' processing and repackaging charges, levies and handling charges make 4-5 times of farm gate prices from Meru District. It

is required to create other marketing alternatives into HCDA managed precooling facility at Nkubu with suitable grading and records MRLs.

Local Consumed Produce

The following crops are produced by a few farmers, and most of them often buy vegetables from outside as confirmed by participation analysis of PCM workshop.

Tomato

Blight variety is planted in this area. The prices of this produce are very fluctuating at Gakoromone and Nkubu markets, where farmer sell the produce in this Project Area. In 1997, tomatoes were glut in January to March, but inversely shortage in November to December because heavy rain gave damages due to prolific diseases and impassable road conditions.

Red Bulb Onion, Cabbage, Carrot

Market conditions of these produce are in the same conditions as tomato, and heavy rain leads to price escalation. Other main production areas are in Kiene East and West Divisions of Nyeri District, where road conditions are bad. This negative factor is inversely desirable for this Project Area due to good access to the Gakoromone wholesale market.

2) Post-Harvest Handling and Marketing Alternatives

Coffee

After harvesting coffee cherries, farmers bring them to coffee factories for pre-grading, pulping, drying and packing to 50kg sacks. Some member farmers of Nkando and Mukiria Coffee Societies sell the cherries by cash to middlemen of private milling factories such as Thika Coffee Mills Co. or other minor coffee millers. The Coffee Cherry Advance System is not applied in these coffee society, which causes delay in payment.

Harvesting, pre-grading

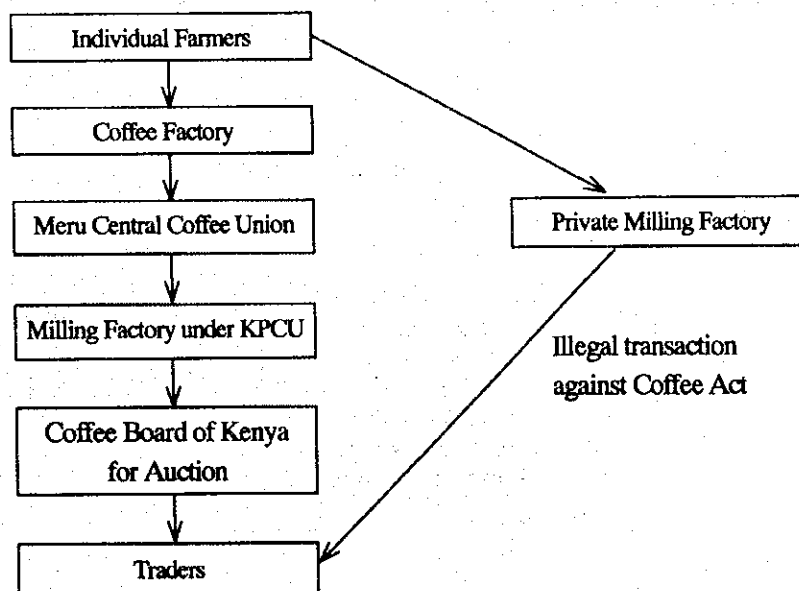
Pulping, drying, packing

Collecting

Milling, storing

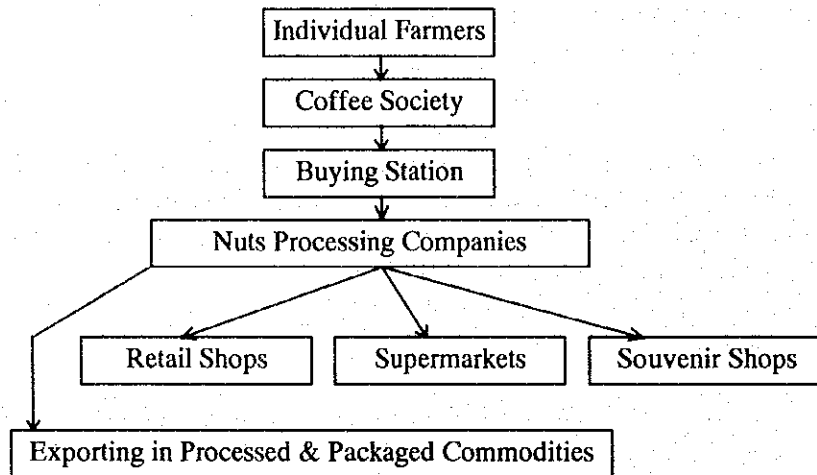
Auctioning, monitoring

Repackaging, exporting



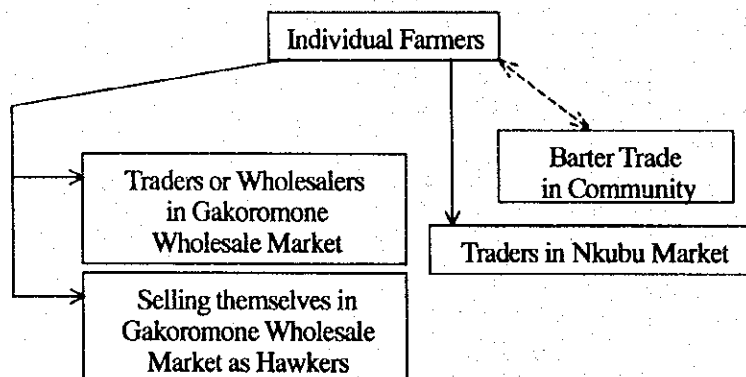
Macadamia Nut

Farmers bring to the Coffee Factories as agreed collecting point with nuts companies.



Horticultural Crops as Local Consumed Produce

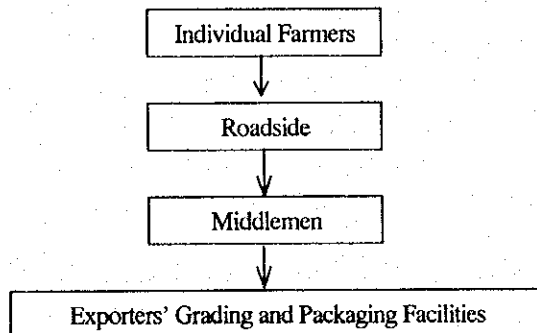
The farmers consume themselves vegetables like tomato, red bulb onion, carrot, cabbage, kale and bring the surplus to Gakoromone wholesale market (6km) for small scale Nkubu market (15km) for town consumers. 51 households out of 106 participated in PCM workshop purchase produce mostly from outside. It is impossible to sell by farmers themselves due to limited space in Nkubu market. In Gakoromone wholesale market, wholesalers, retailers, hawkers of farmers and also other commodities (hardware and cloths) of retailers are mixed up, thus farmers can not take good place and quite unfair allocation of blocks is identified.



Rare cases

Horticultural Crops as Export Produce

The main export produce are French bean in scarce cases in this Project Area. Farmers pre-grade and packaging into carton boxes in roadside. Exporters do not purchase directly to farmers, but purchase through middlemen. Farmers do not have the way to know the price at exporters grading houses located at Nairobi, therefore are forced to accept the offered prices from middlemen.



3) Regional Market Aspects and Trading by Crop

From Meru District, large amount of produce outflow to Nyambene, Tharaka Nith, Embu, Laikipia, Nairobi, Machakos, Mombasa, Kitui, Mwing, Isiori, Wajir, Garissa, Nakuru, Nyandarua and other districts. Gakoromone wholesale market has second largest trading volume in production sides following Karatina Wholesale Market in Nyeri District, but the facility of the market has not been improved. The operation is done by Meru Municipal Council. The trading volume was estimated at 59,700 tonnes per year or 380 tonnes per day, for which figures, there is no any data to state the trading volume, so the Study Team estimated from the Market Gate Fees in the fiscal year 1997/98 collected by the Council. In this market, the collecting rate is relatively lower due to lack of fences or walls.

Estimation of Trading Volume at Gakoromone Wholesale Market:

Annual Trading Volume

= Σ {Monthly Collected Fees (3.35 million Ksh \times Collected Ratio (40% from July 1997 to June 1998) \times Market Fee Rates (20Ksh/90kg bag at 60% and 100Ksh/5t lorry at 40%)} = 59,700 ton/year

Average Daily Trading Volume

= 59,700 ton \div 52 weeks/year \div 3 times/week (on Mondays, Wednesdays & Fridays) = 380 ton/day

The price fluctuation and supply by crop can be summarized as below (the following prices as of in 1997 average excluding September to August and December):

Avocado	:	Local produce and exported. Stable and very low priced. 5Ksh/kg.
Banana, Cooking	:	Local and inflow produce from Tharaka Nithi District. 12Ksh/kg.
Banana, Ripe	:	Local, exported some apple variety ripe banana and outflow produce. Stable priced. 17Ksh/kg.

Bean, Canadian Wonder:	: Local produce. During drought double priced. 50Ksh/kg.
Bean, Dolichos:	: Same as the above. 57Ksh/kg.
Bean, Mwiternia:	: Same as the above. 45Ksh/kg.
Bean, Rose Coco:	: Same as the above. 44Ksh/kg.
Cabbage:	: Local and outflow produce. Irregularly fluctuated and affected by heavy rain. During drought double priced. 8Ksh/kg.
Carrot:	: Local and outflow produce. Irregularly fluctuated and affected by heavy rain. 7Ksh/kg.
Cowpea:	: Local and inflow produce from Tharaka Nithi District. During drought double priced. 44Ksh/kg.
Green gram	: Same as the above. 59Ksh/kg.
Ground Nut, Shelled	: Local produce. 46Ksh/kg.
Kale	: Low demand Local produce. 7Ksh/kg.
Maize, Dry	: Stable demand. Local and outflow produce. During drought triple priced. 16Ksh/kg.
Maize, Green	: High demand. Local produce. During drought triple priced. 16Ksh/kg.
Mango	: Local produce. Low price. 7Ksh/kg.
Millet, Bulrush	: High demand. Local and inflow produce from Tharaka Nithi District and others. High priced in 1997. 29Ksh/kg.
Millet, Finger	: Very high demand. Local and inflow produce from Tharaka Nithi District and others. High priced in 1997. 23Ksh/kg.
Onion, Red Dry Bulb	: Local produce. Irregularly fluctuated and affected by heavy rain. 19Ksh/kg
Onion, Spring	: Local produce. During drought double priced. 7Ksh/kg.
Orange	: Low supply seasonally. Local and inflow produce from Machakos District. 12Ksh/kg.
Passion Fruit	: Local produce and exported. 12Ksh/kg.
Pigeon Pea	: Local and inflow produce from Tharaka Nithi District. 39Ksh/kg.
Pea, Fresh	: Local produce. During drought triple priced. 29Ksh/kg.
Pineapple	: Local produce. 11Ksh/kg.
Potato, Red Irish	: High supply and high demand. Local and outflow produce. Irregularly fluctuated and affected by heavy rain. 11Ksh/kg.
Potato, Sweet	: High demand. Local produce. Prices are not collected in 1997.
Sorghum	: Local and inflow produce from Tharaka Nithi District. 24Ksh/kg.
Tomato	: Local produce. Very fluctuated seasonally at four times. 13Ksh/kg.
Wheat	: Local produce only in Timau Division. Irregularly fluctuated. 20Ksh/kg.

4) Farm-to-Market Roads

The conditions of B6 road from the Project Area to Gakoromone wholesale market and Nkubu markets are well maintained in all season, but the transport using *Matatu* are costly; 60kg bag is equivalent cost to one person at 20Ksh to Meru town.

3.1.6 Agricultural Extension Services

1) Institutional Extension Services

a) Ministry of Agriculture (MOA)

Presently the Ministry of Agriculture (MOA) is the main provider of agricultural support services to the Project Area and has deployed technical staff at various administrative levels as illustrated below:

Provision of Agricultural Extension Services at the District Level

District Level (Meru Town)	Division Level (Ab. Central, Mariene)	Location Level (Gatimbi)	Sub-location Level (Ngerwe)
- 1 x District Agricultural Officer	- 1 x Divisional Agricultural Extension Officer	- 1 x Location Agricultural Extension Officer	- 1 x Agricultural Extension Assistant
- 10 x Subject matter specialists: extension, irrigation, crops, horticulture, coffee, farm-management, marketing etc	- 3 x subject matter specialists: horticulture, farm- management, irrigation		

- Note :
- 1) The above staffing situation refers to the Department of Agriculture and does not include personnel belonging to the Departments of Livestock Development and Veterinary Services.
 - 2) The staffing situation is not static and does fluctuate as a result of transfers.

It is at the location and sub-location level where "frontline extension workers" (FEWs) are supposed to make regular contacts with the farming community and transfer improved agricultural technologies. Extension officers located at division and district levels are normally expected to provide back-up support to FEWs in such areas as strategic planning, skills upgrading and performance supervision.

With the completion of the World Bank supported "National Extension Programme" NEP II, the mobility of extension staff has been severely constrained owing to lack of operational finance and transport facilities. Consequently, individual and group farmer contacts as well as skills upgrading of frontline extension workers has become irregular.

The extension services are, however, currently being drastically re-structured as part of the on-going ASIP (Ref. Proposal on the National Agricultural Livestock Extension Programme, NALEP, "Draft No 3", Ministry of Agriculture April 6, 1998). Among other factors, NALEP will be based on the following:

- Extension to be demand-driven taking due recognition of GOK's policy commitment to liberalization, privatization, and commercialization of the agricultural sector
- Increased involvement of the private sector in providing extension services
- Sharing of extension delivery costs by beneficiary farmers
- Use of participatory approaches in extension (involving main stakeholders in problem diagnosis, planning, appraisal and implementation of agricultural projects)

b) Other Government Agricultural Support Services

There is a Coffee Research Out-station at Mariene which provides a range of support services to coffee growing farmers of the Project Area. These services include:

- Soil and leaf analysis with a view to advising on appropriate fertilizer regime
- On-farm demonstrations on coffee husbandry
- On-station training by means of field days

2) Agricultural Extension Services by the Private Sector

In Meru a number of private sector agricultural services and NGOs are currently operating. The private sector is working mainly in the provision of inputs and fertilizer to coffee cooperatives and growers, and the supply of artificial insemination services. There are a number of NGOs active in Meru district, including Plan International which has been involved in irrigation development in the district. Various church groups, especially the Catholics have been working on encouraging farming in the vicinity of the project.

3.1.7 Agricultural Credit

1) Institutional Credit

The Project Area is located 10 km from the Meru town, which is the center of Meru district, but located near the national road. Institutional credit services are available in Meru town. The rate of farmers that are given credit services account for 47.5 percent, which is the highest among the four Project Areas. The debt is incurred from the agricultural materials for coffee cultivation through the coffee cooperative.

Reasons that other farmers don't utilize credit service are as follows; i) They don't have title deed as collateral, ii) credit condition such as interest are severe, iii) less transparent in credit service, iv) lack of information and so on. Some 67 percent of farm households interviewed in the farm economic survey answered that they feel difficulty in accessing to credit of AFC and CBK.

2) Informal Credit

Farmers who cannot utilize institutional credit borrow money from private lenders such as relatives and neighbors in the area.

3.1.8 Farmers' Organizations and Their Activities

1) Cooperative Society

The farmers of the Project Area are members of a coffee cooperative society which has installed two factories within the Project Area. The main activities of these factories are:

- Installing processing facilities and coffee stores
- Processing and marketing of farmers' coffee
- Provision of farm inputs on credit to members and on a cash basis to non-members
- Provision of cash credit for emergencies to members

2) Water User's Association

There is a project water users association of 140 members which is registered with the Ministry of Culture and Social Services. The association's main activities are:

- Organizing of members to contribute towards the cost of installing a water intake and laying a supply pipeline into the Project Area
- Undertaking repair of intake or pipeline as necessary
- Allocating domestic/irrigation water to members
- Resolving any water disputes or complaints on water distribution
- Planning capacity expansion of the existing water supply system in order to more adequately cater for irrigation

The WUA has delegated day to day activities of the association to a management committee.

At present, the water supply is mainly being used for domestic use (human and livestock) as well as for spraying coffee. However during the dry months of January-February and August-September, some limited irrigation is practiced for kitchen gardens.

3) Marketing Groups

Besides processing and marketing of coffee by the two factories, there is no other arrangement for group marketing of farm produce. Currently rainfed produce (including horticulture) is sold on an individual basis.

4) Women's Groups

During the field workshops, some five women groups were identified as active within the Project Area (Ref. participation/stakeholder analysis). These women groups are engaged in self-help activities aimed at improving their members welfare through "Merry-go-round" money contributions for;

- Procurement of domestic utensils
- Installation of water tanks

- Buying livestock
- Buying roofing iron sheets
- Emergency assistance towards payment of medical bills, school fees etc.

5) Other Community Associations/Organizations

There is a dipping facility which is operated and maintained by the local community for the purpose of livestock tick control. Other informal associations, mostly formed by men on a family or clan basis, are aimed at providing mutual assistance in situations that require considerable financial expenditure (wedding, school fees) or in the case of emergency (medical bills, funeral expenses).

6) Non-Government Organizations (NGOs)

During the field workshop, there was no indication of a NGOs operating within the Project Area. However, there are a number of Christian churches (Catholic, Methods and others) whose main focus is provision of spiritual services to the local community.

3.1.9 Irrigation Water Sources and Water Permit

The water source of project is Mariara river which is a tributary of the Kathita river. The catchment area above the intake site is only 32 sq.km., but since the area is located in the Mount Kenya Forest with high rainfall, the water is available year round. The river length from the origin to the intake site is 12 km and the river slope around the intake site is 1/30.

The river is gauged at RGS-4F5 which is located at just downstream of the scheme with a catchment area of 42 sq.km as shown in Figure 3.1-1. The station has discharge record of 26 years from 1970 to 1996. The high flow occurs two times in December and May and the lowest flow occurs in September. The annual mean flow and low flow are 1.7 cu.m/sec and 1.1 cu.m/sec respectively. The variation of monthly runoff is shown in Table 3.1-1.

The scheme has the authorized water permit for domestic and irrigation water use. However, the allocated water for present scheme is only 2.75 lit/s. There exist 42 projects holding water permit in the upper basin of the scheme. The total amount of authorized water is 0.639 cu.m/sec. While, 21 water permit exists in the down-stream up to the junction of the Kathita river and the total amount is 0.05 cu.m/sec.

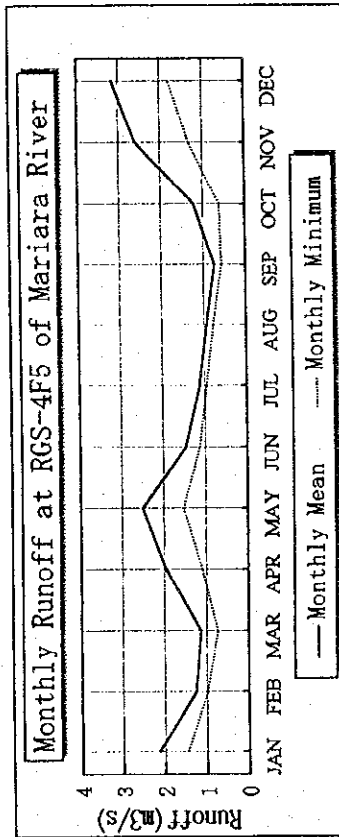
3.1.10 Irrigation and Drainage

The irrigation system was improved to the present water supply system, which includes some irrigation water use in 1989.

The system consist of PVC pipeline of about five kilometer length with a diameter of six to one inches and 106 outlet tap-stands with a diameter of 1/2 inches as individual house connection. But, any control valves are not facilitated in the system. The pipeline alignment is shown in Figure 3.1-2.

Table 3.1-1 Monthly River Runoff at RGS-4F5 of Mariara River

RGS	YEAR	ITEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Mariara River(C.A. = 42 km ²)	1970-96	MEAN	2.14	1.26	1.14	1.96	2.50	1.47	1.12	0.94	0.75	1.22	2.59	3.15	1.69
		MINI	1.46	0.99	0.74	1.10	1.54	1.14	0.96	0.79	0.59	0.62	1.34	1.80	1.09



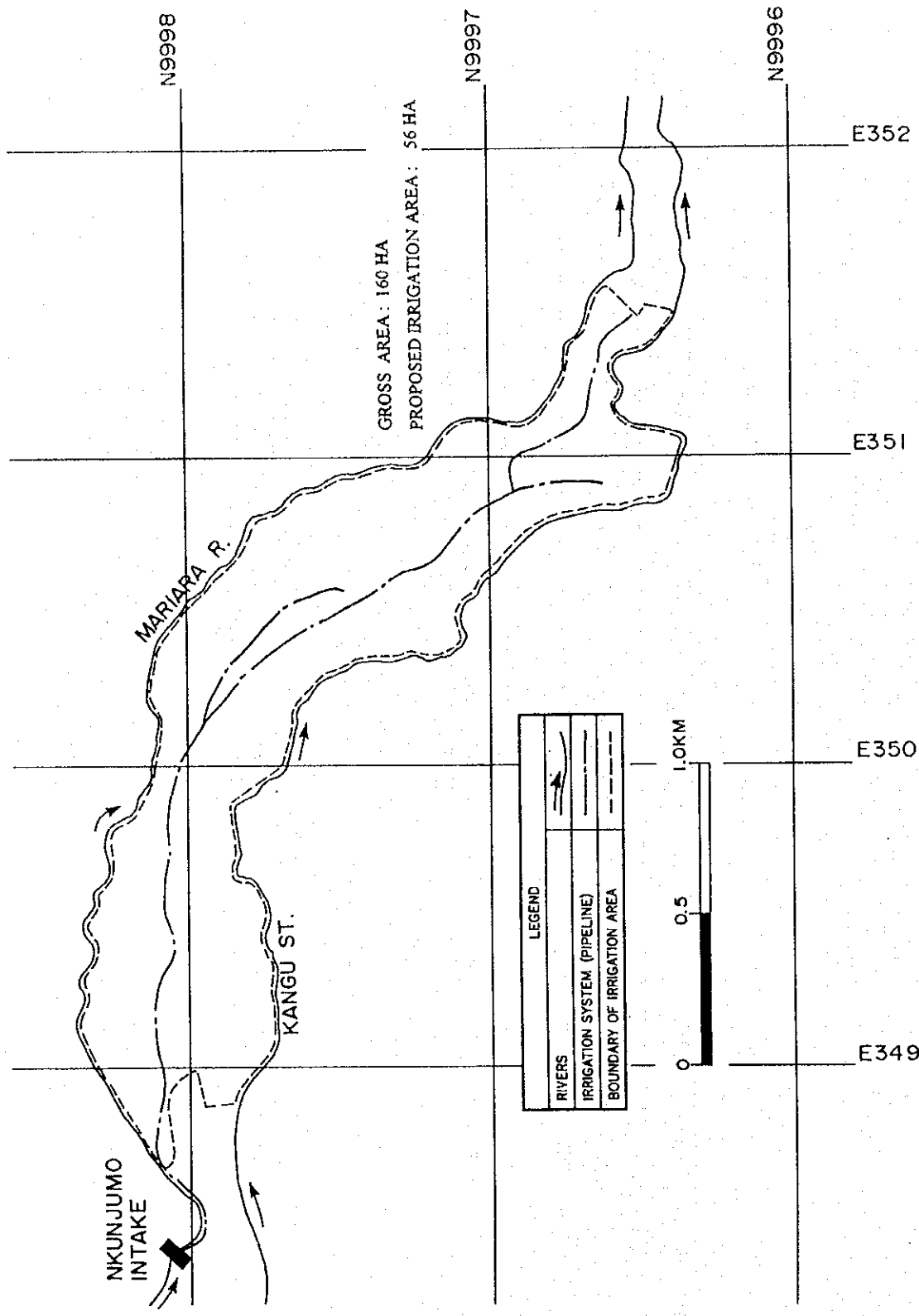


Figure 3.1-2 Irrigation Area of Nkunjumo Water Project

The gross area of this scheme is 160 ha in 106 farm plots and major crops are maize, beans and coffee. Currently 11 ha only are being irrigated by 106 households. Scheduled irrigation for equal water distribution is not planned, and there is no consensus on water allocation within the members. Consequently, some irrigators whose irrigation area are located at the downstream of the system and higher land frequently suffer from water shortage.

The causes of water shortage are as follows;

- Intaked water amount can not meet the water demand for irrigation due to the limited capacity of existing pipeline system,
- There is no rule on water allocation within the scheme member and
- Lack of knowledge on water management due to weak extension service.

The irrigated crops grown are vegetables, cabbage, potato, kale, French beans, onion etc. As a water application for irrigation, a low pressure sprinkler system is adopted. The adopted operation time and interval of irrigation are 12 hours per day and four days respectively.

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

3.1.11 Agriculture and Rural Infrastructure Conditions

1) Irrigation and Drainage

Nkunjumo Water Project is originated from the self-help water supply project for domestic water use only in 1971, then the system was improved to the present water supply system which includes some irrigation water use in 1989. The system has just minimum facilities and structures since it was built only with fund contributed by association members and therefore pipeline capacity is not sufficient for irrigation water.

Major facilities of the system are an intake weir, a intake box, pipeline and individual water tab stands. Mariara river is a very steep river and its riverbed is mostly rocks. The intake weir with guide wall is just a simple concrete structure built on the riverbed rock. The intake box with wire mesh screen is a small concrete structure located at the right bank of the river. Both weir and intake box seem to be in fair condition except mesh screen and silting function. PVC pipeline with a total length of around 4.5 km is gravity system with diameter of six to one inches (ϕ 150 - 25 mm). There are two division points in the pipeline without valves and 140 outlet tab stands with diameter of 1/2 inches (ϕ 12.5 mm) as individual house connection. As farm lands are very steep, sprinkler irrigation is practiced in the Area extending by vinyl pipes from water tab. However the upper reach of the system dose not have enough water pressure for sprinkler irrigation.

There is a water users association named Nkunjumo Water Association with 140 members for O&M of the water supply system. O&M fees have not been collected from members but it is under planning. Major O&M activities are only cleaning of the intake box.

2) Domestic Water Supply

Present water supply system is functioning with sufficient capacity for domestic water use and is well operated. The water supply system covers 140 households with house connection and two schools located in the Project Area, namely Abothuguchi secondary school and Mukiria youth polytechnics.

There is no water treatment facilities such as filtration and chlorination, thus farmers have to boil the water for drinkin. There are some coffee factories at upstream of Mariara river where Nkunjumo water supply system is tapping water. Details of facilities and structures of the system are as presented in the previous section "a) Irrigation and Drainage". Condition of facilities of the gravity pipeline system from the intake weir to individual water tab stands is good even if some necessary facilities are lacking like water treatment facility, water storage tank for schools and stop valves at division points.

There are approximately 30 non-member households residing in the Project Area, and they take water from Mariara river or other small streams for domestic use.

3) Rural Roads

Since B6 tarmac road (national trunk road) is crossing at the lower part of the Project Area, access to the Area is very convenient. The B6 road is in good condition maintained by MPWH.

On the other hand, village/farm roads in the Area are in poor condition at many sections particularly where roads are passing steep terrain. Roads become impassable during rainy seasons from March to May and from October to November. They are all earth surface roads with 3.0 to 4.5 m in road width. These village roads belong to Meru County Council which is responsible for O&M. However actual road maintenance has been carried out by communities as organized by Assistant Chief of Nyweri Sub-Location. When equipment such as trucks and graders is required for the road maintenance, those are arranged by County Council or MPWH but community has to pay for fuel.

4) Rural Electrification

There is no electric power supply in the Project Area. However recently Mukiria Coffee Society which has five coffee factories and covers the Project Area has a plan to get power line to the factories. The planned power line route was surveyed by Kenya Power & Lighting Company and it will pass along the main village road. As most farmers in the Area produce coffee and they are also member of the coffee society, they may receive electric power services under certain conditions depending on the arrangement among coffee society, Power Company and communities.

5) Public Health

Gatimbi health centre, three kilometers from the Project Area, is the nearest public medical facility where a clinic officer and nurses are stationed. Further medical treatment can be received at Meru district hospital (11.5 km) and Nkubu mission hospital (3.5 km).

6) Education

There is no primary school in the Area but two schools, namely Mariara primary school and Nyweri primary school, are located just at the border of the Project Area. Abothuguchi secondary school is in the Area with 500 pupils and 40 teachers. Mukiria Youth Polytechnics is also in the Area with 30 students and four teachers.

3.1.12 Post-Harvest and Rural -Agro-Industry

1) Post-Harvest

For export produce, the losses are estimated at 20-60 percent in quantity due to spotting and 30-40 percent in quality caused by poor grading techniques, lack of timely price information, low seed quality and weak bargaining power to middlemen. The coffee cherry losses are estimated at 10-30 percent.

2) Rural Agro-Industry

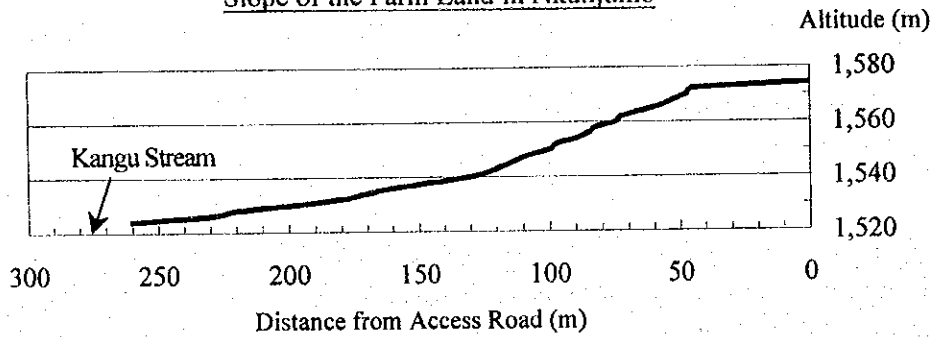
The coffee factory located near the Project Area has the functions of pulping, drying, pre-grading, temporary storing, farm inputs supply and communication with Meru Cooperative Union to supply clean coffee cherries. But many of farmers are selling other private milling companies not through coffee societies and Coffee Board of Kenya, which disorganization can be occurred at the stage of sectional liberalization of agricultural produce marketing. The Coffee Board of Kenya is insisting on effectiveness of Coffee Act stipulating the function of the Board in coffee marketing, but it may be required to testify the benefits for planters to join computerized coffee auction connecting information to the prices at New York market, supply farm inputs, secure brand as 'Blue Maintain', apply advance payment system in cooperation with Kenya Cooperative Bank and other institutional services.

3.1.13 Rural Environment and Public Health

1) Natural Conditions

The Project Area has a very steep slope surrounded by valleys of Mariara River, where the intake of water supply was constructed, and Kangu Stream (see Figure T.2-6, Annex T). The most of farmlands face the river, e.g. with the incline of 33 percent (18°) at some parts of Kangu Stream side, 165 m downstream from the intake as shown below. The slope of the opposite side along Mariara River is extremely steep, the incline of 56 percent, and covered with trees.

Slope of the Farm Land in Nkunjumo



The source of Mariara River is Mt. Kenya Forest, though the catchment area covers nearly all the agro-ecological zones of upper parts of Meru District. The main species of fish in Mariara River is trout, though fishery is not important in Meru and not practiced in the Project Area. Damages of crops by wildlife in the Project Area does not occur as there are no nearby game reserves and the Project Area is surrounded by another farmlands.

Meru National Park is situated over 40 km east from the F/S Area and covers 870 sq.m. It was established as a Game Reserve in 1957 and gazetted as Meru National Park in 1967. The park has several swamps and boasts of a total of 15 rivers and streams draining Tana River. However, the water quality is now being threatened by pollution that originates from upstream activities such as mushrooming horticultural production, increasing population and water resources development projects along the headstreams of Tana River. For example, Bwatherongi River, one of the rivers flowing into Meru National Park was reported dried due to unplanned irrigation in its catchment.

2) Health and Sanitary Conditions

As for the drinking water, 78 percent of households use the tap that is taken from Mariara River without treatment and connected in each homestead. 22 percent use the water of river or stream being faced their farmlands at an average distance of 171 m from the homestead. Details are shown below.

Sources of Drinking Water in Nkunjumo Water Project

Source of Water	Households (%)		
	July 1998	Dry Season	Rainy Season
Tap water	78	69	59
River	22	31	9
Roof Catchment	0	0	32

Source: EIA Survey, July 1998

The water quality of Mariara River is over the standard for drinking water on some parameters as summarized below. Details of the water quality analysis are shown in Table T.2-4, Annex T.

Summary of the Water Quality Analysis

		Standard	Mariara River	
			Intake	7 km Downstream
BOD	(mg/l)	<1	7.5	5.0
HCO ₃	(mg/l)	<25	51.9	42.7
E. Coli.	/250 ml	-	+	+

Source: EIA Survey, July 1998

As for the construction material of house, 98 percent of houses have corrugated iron sheet roof and two percent have thatched roofs. About 84 percent of the houses have cemented or concrete walls, while 16 percent have mud walls. 97 percent of households have a pit latrine which depth is four to five meter and three percent have flush toilets.

The cooking stoves being used in the Project Area are not three stones but various type of improved cooking stove. It is the result of the Special Energy Project (1983 - 1994) implemented by GTZ for the promotion of improved cooking stove with the target of whole country, and it was made in 7,242 households in Meru District by the training of women's groups including the Project Area.

Malaria ranks as the top disease in Gatumbi Dispensary within two kilometer from the Project Area as shown below.

Common Diseases Reported in Gatumbi Dispensary

Diseases	(Unit: case)	
	Year	
	1996	1997
Malaria	8,741	6,797
Upper Respiratory Tract Infection	8,490	6,569
Skin Diseases	1,966	1,788
Intestinal Worm Infections	876	983
Diarrhea	55	214

Source: EIA Survey, July 1998

3) Soil and Water Conservation Conditions

In this area, most of the farmlands are occupied by coffee, and some crops for home consumption are growing around the house and near the river (e.g. see Figure T.2-7, Annex T). Some coffee fields are well managed by terrace with *Paspalum notatum* (Bahia grass) that is effective as terrace banks.

The farmers' awareness for the soil and water conservation is shown in the next table. Most of farmers practice the plantation of trees and Napier grass, mainly along the river.

Farmers' Awareness for the Soil and Water Conservation

Soil and Water Conservation Activities	Farmers' Answer (%)	
	I know.	I practice.
Planting trees	91	91
Planting of Napier grass	100	94
Contour cultivation	69	47
Stone wall along contour line	25	22
Others (Planting of sugarcane, bananas & papaya along rivers)	31	31

Source: EIA Survey, July 1998

4) Use of Agrochemical

77 percent of farmers use agrochemical, mainly fungicide and insecticide for coffee as shown below. All of them are approved for agricultural use in Kenya.

Crop	Agrochemical
Coffee	: Fungicide : Copper Nordox, Green Copper : Insecticide : Sumithion, Karate EC2, Lybacyd 500 EC
French beans	: Karate EC2, Dimethoate 400, Lybacyd 500 EC
Kale:	: Sumithion, Dithane M 45
Beans	: Dithane M 45
Maize	: Thiovit
Irish potatoes	: Dithane M 45
Tomato	: Dithane M 45

In addition, some herbicides such as Atrazine, Diuron, Simazin, Fluome, Amitrole, 2,4-D MCPA and Paraquat, are used commonly in coffee field in Meru. However, Atrazine and Paraquat are not permitted for agricultural use in the EU.

According to the EIA Survey, all farmers answered to have the knowledge of agrochemical use, though 47 percent answered that they followed the recommended dilution and 68 percent answered that they followed the recommended application interval. Actually, 43 percent of agrochemicals were used within the recommended dilution. The dilution by farmers was unknown for 38 percent of agrochemicals and the application interval by farmers was unknown for 29 percent of agrochemicals. All farmers know that they must use gloves and mask when they use agrochemical, though most of them do not practice as shown below.

Farmers' Awareness for the Agrochemical Use

Questions	Farmers' Answer (%)	
	I know it.	I practice it.
Dilution of Agrochemical	100	47
Use of Gloves and Mask	100	26
Maximum Pesticide Residue Levels	71	0

Source: EIA Survey, July 1998

Actual Agrochemical Dosage by Farmers

Agrochemical Use	% of Agrochemical
Within the Recommended Dilution	43 %
Less than the Recommended Dilution	(8 %)
Equivalent to the Recommended Dilution	(35 %)
Over the Recommended Dilution	19 %
Unknown	38 %
Recommended Application Interval was followed	56 %
Recommended Application Interval was not followed	15 %
Unknown	29 %

Source: EIA Survey, July 1998

5) Related Projects on Environment and Public Health

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

Name of Project	Donor	Duration	Method	Results
National Agricultural Extension Program	SIDA	1986	Training of farmers & staff including soil conservation	Success
Fertilizer Extension Program	GTZ	On-going	Farmer training & Research	
Water & Sanitation Program	SIDA	On-going	Training of staff & community: construction of water tanks, water jar and latrine, spring protection, home improvement	

Source: EIA Survey, July 1998

3.1.14 Gender Issues

1) Women's Status in Rural Society

The present status of women in Nkunjumo Water Project is a product of both traditional norms and attitudes on one hand and the impact of modern institutions on the other. During the field workshops, it was noted that women preferred to sit very much separated from the men and were reluctant to volunteer any comments. There was no woman in the project management committee which is dominated by relatively old people.

2) Women's Roles in Farm Households

Women roles in the household are shaped both by tradition as well as by the extent and rate of the community's integration into the national and international market economy (coffee production, new off-farm activities). At the household level, the household distribution of tasks between female and male adults is illustrated as follows.

Task Distribution between Female and Male Adults

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

Note: X = Sometimes; XX = Main responsibility

The above table clearly indicates that the disproportionately large number of household activities are discharged by women. Hence in the design of the irrigation system, relevant gender issues will have to be considered and incorporated. Such issues are:

- Labour implications of the irrigated production system
- Change in income/benefit status for household female members
- Current commitments, preferences, and capabilities of women members of the household

3) Women's Rights to Land Inheritance

According to local tradition, women have user-rights to land but are not permitted to own or inherit it. However, it was indicated that these traditions attitudes are weakening as women gain in status through education and subsequent access to well paying jobs (teaching, civil service, private sector).

4) Women's Rights to Selling of Agricultural Products

Field discussions indicated that women share with the men in the right to market subsistence crops (maize and beans), bananas, sweet potatoes and kales. The right to market coffee, however, remains a male privilege although a wife may be consulted on how the proceeds will be used.

3.1.15 Findings through Workshop Seminars held at Nkunjumo Water Project

Workshop seminar at Nkunjumo Water Project categorized into Type-D was held at project site during the period from July 7, 1998 to July 10, 1998 with a participation of beneficiary farmers of the scheme, and through the seminar under eager discussion among farmers, the studies on i) members and relevant information, ii) participatory/stakeholder, iii) problem analysis, iv) objective analysis, and v) project design matrix (PDM) were analyzed.

Followings indicate the outlines of problem analysis and PDM, and Figure 3.1-3 and Figure 3.1-4 indicate the problem and objective trees of the Area. The details are referred to Table C.2-7 to Table C.2-9 and Figure C.2-7 to Figure C.2-9, Annex C.

- Prioritized Present Problems;
 - Lack of money in households
 - Food for home consumption insufficient
 - Insufficient diversity of planting seed/crops
 - Poor marketing arrangement for crops
 - Lack of market for produce
 - Low price for produce

- Overall Goal : Uplift standard of living
- Project Purposes : Sufficient irrigation water
- Results/Output : Proper intake installed
 - : Adequately sized pipes installed
 - : Arrangements of operation and maintenance in place

Figure C.2-7 Problem Tree for Nkunjumo Water Project

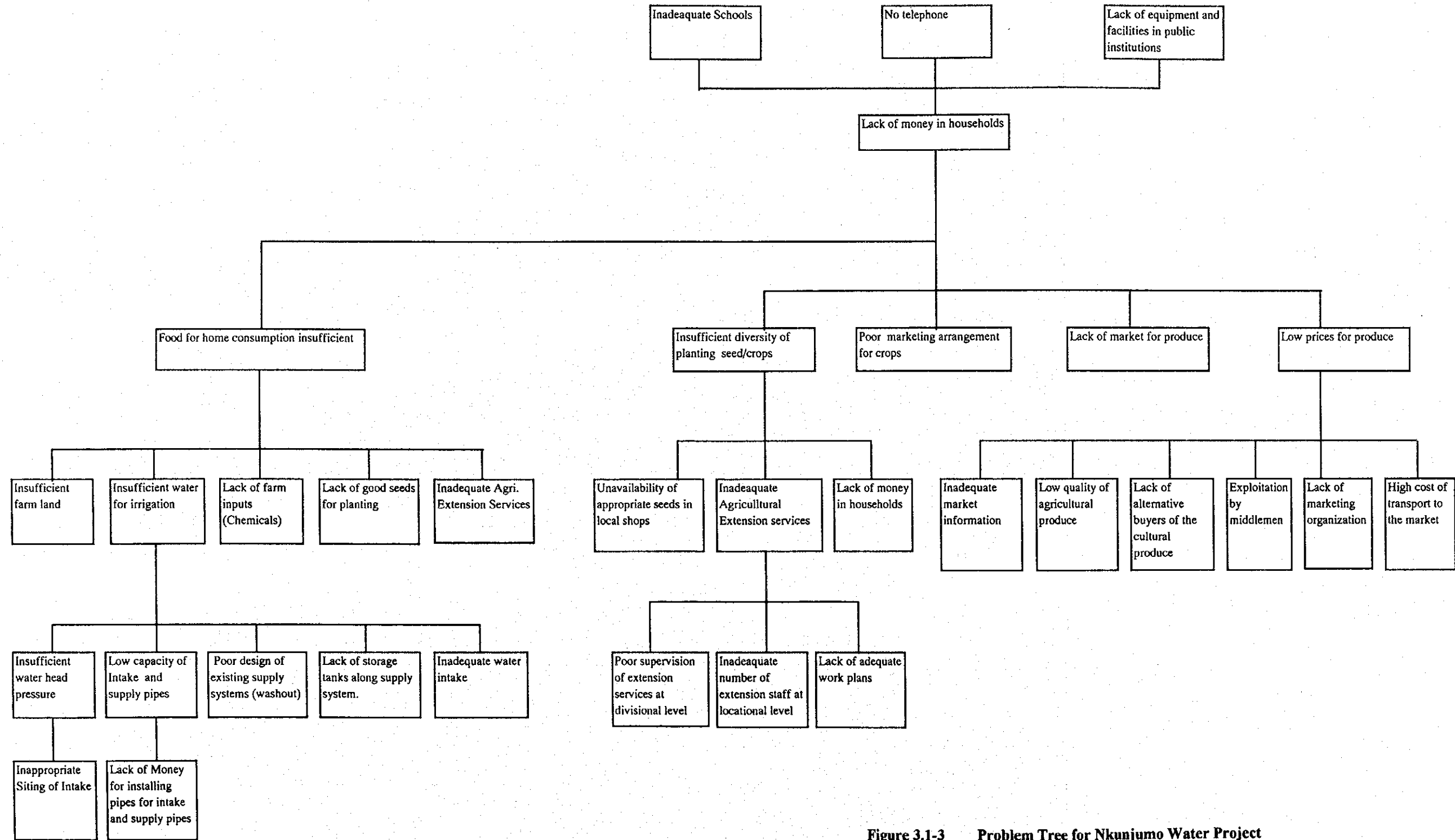
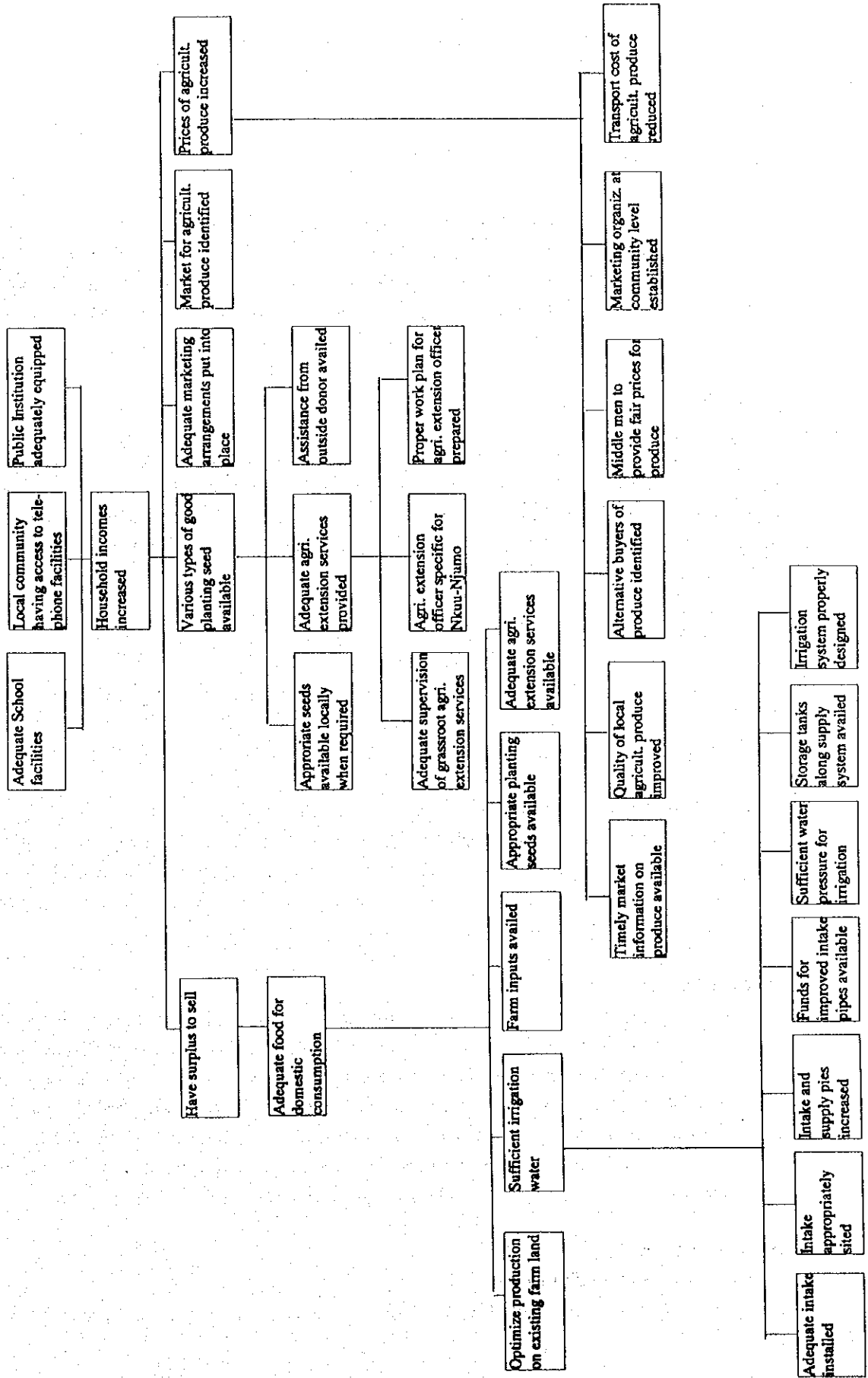


Figure 3.1-3 Problem Tree for Nkunjumo Water Project

Figure 3.1-4 Objective Tree for Nkunjumo Water Project



3.1.16 Present Problems, Constraints and Development Potentials

1) Present Problems and Constraints

a) Rural Community

Presently, the rural community has a stable social base. However, the community is facing the challenge of introducing new agricultural technology as well as adapting new management practices. The gap between small and large-land owner is considerable. Hence, implementation of the irrigation scheme is likely to induce formation of two classes depending on how irrigation water and associated benefits will be allocated.

b) Crop Production

The current cropping pattern in the area is dominated by coffee, and any expansion of irrigated horticultural production will have to compete with the coffee for labour. The steep slopes and friable soils are susceptible to erosion, and there will be a need to guard against erosion especially as cropping intensifies. Some of the area has acid soils that may require special management. The availability of both flat land and water are also limited.

c) Marketing

As the result of PCM workshop, the following problem tree were suggested in marketing sector:

- Lack of money in households

- Poor marketing arrangement for crops

Marketing arrangement is possible and effective, when increased trading volume and improved qualities in produce itself and grading, but currently marketed by individual farmers. The organization for horticultural marketing must have well-known relationships among members, not like large-scale cooperatives.

- Lack of market for produce

Marketing alternatives for both locally consumed and export produce are existing, which are outflows to wholesaler and retailers at Gakoromone wholesale market, retailers at Nkubu market, main roadside, exporters, middlemen and future construction Nkubu satellite depots for auction. The accessibility to markets and the precooling facility at Nkubu creates more strong competitiveness in the specific produce such as red bulb onion, cabbage, tomato, carrot and red irish potato in heavy rain season for local markets, and Monel french beans, snow pea, sugar snap and Hass or Fuerte avocados for export. Farmers may not be able to appraise their resources.

- Low prices for produce

• Inadequate market information

Currently, farmers are dependent on information source from middlemen. Market information can

be detained by means of participation in market, analysis of commodity prices on the newspaper and contact with DAO farm inputs/marketing officer in Meru DAO and HCDA marketing officer in Meru District.

- Low quality of agricultural produce

The quality at farm level can be determined by seed variety, weather conditions, spotting diseases, insect bites and grading. The group purchase of certified seed can be made feasible than individual arrangement, with the cooperation of DAO farm inputs/ marketing officer in Meru DAO and HCDA marketing officer in Meru District.

- Lack of alternative buyers of the agricultural produce

Only four middlemen for french beans visit to this Project Area. The coordination among production farmers of French beans is required to increase transacting alternatives with middlemen and exporters. In order to increase demands from outside, the farm planning can be a first significant activity through discussion among members of marketing groups based on analysis of market information at Gakoromone wholesale market and commodity prices on the newspaper and weather forecast.

- Exploitation by middlemen

The complains of farmers are unsatisfactory buying prices and late payment.

- Unsatisfactory buying prices:

Farmers don't have any means to get FOB prices or exporters' buying prices timely and suspect that middlemen visiting this Project Area may conspire to agree prices among them. If price is low, middlemen would explain the reasons, which can not be confirmed by farmers, such as reject by exporters due to poor grading, offered low prices by exporters due to demand and supply in importing countries, increasing transport costs to Nairobi, poor produce quality in drying, dirt, spotting and insect bite.

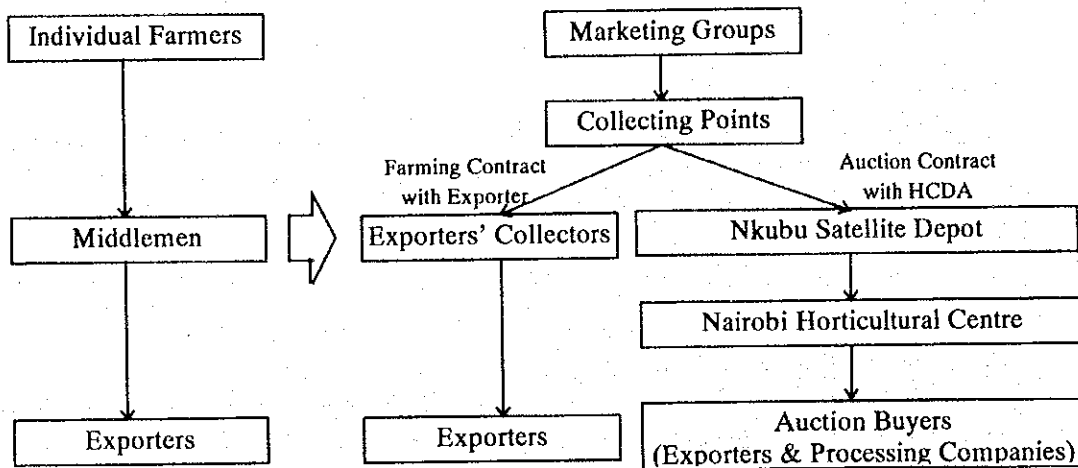
- Late payment:

Middlemen repay to farmers after getting cash from exporters and calculating fuel costs and wages for staff, and had never paid in advance. It normally takes about two to four weeks before payment. In some cases, middlemen don't pay farmers when there is glut in importing countries and high exchange rate of Kenya Shillings.

- Lack of marketing organization

Farmers understand marketing group can be one of measures to combat with exploitation by middlemen. The possible marketing alternatives for export produce are as follows;

Marketing Flow for Export Produce



- High transport costs to the market

Group loading is desirable. The distance (6km) and road conditions from the Project Area to Gakoromone wholesale market are comparatively advanced than other irrigation schemes.

- Unimproved market facilities to meet potential traded volume

From the position of sellers:

- i) Since there is no roofing, the transaction activities and produce qualities are affected by rain because of high rainfall especially in March to May, October and November in the site.
- ii) Since there is no roofing, intense sunshine in January to February and June to September makes produce lower in quality due to high respiration rate of produce, drying of leaf vegetables and shorter shelf life.
- iii) Loading and unloading of produce by lorries are inefficient due to mixture of wholesalers, retailers, hawkers, buyers and hardware/clothe retailers, also expanding on the road sides and surrounding private plots.
- iv) Since there is no enclosure by fences or walls, collection of market gate fees by Meru Municipal Council is difficult, which creates unfairness among sellers.
- v) Since there is no pavement on ground by concrete or concrete blocks, the prices of produce become lower by dirt.
- vi) Since there is no availability to stock produce in warehouses, wholesalers are forced to be driven a hard bargain.
- vii) Since there is no fair allocation in selling places for hawkers or farmers, they concentrate along roads or near access road to town centre. This condition can lead one of reasons of corrupted relationship between fee collectors of the Council and hawkers. They wish fair allocation even if paying fees.
- viii) Since there is no means to obtain timely market information in other markets, the expectation of demands is very difficult for traders to other markets.
- ix) Since there is no market facilities and services, the sellers perceive that the market gate fees are a kind of commission which nothing benefits, and don't want to pay them.
- x) Since there is no lights, transactions in early morning at 5:00am are not easy to inspect produce for traders going to other markets.

From the position of buyers:

- xi) Since there is no roofing and paving, buyers don't want to enter market due to dirt.
- xii) Since there is jams of people, produce and vehicles, buyers lose incentive of selection of sellers.
- xiii) Since there is no roofing, buyers lose incentive to purchase in the market.
- xiv) Since there is quite limited space for loading, buyers lose incentive to purchase in the market.

From the position of management body:

- xv) Since there is no fencing, it is difficult to collect market gate fees from sellers and even the collectors. Collection rate is estimated at 40 percent or less according to Town Clerk (head of administrative side) and Town Engineer of the Council.
- xvi) Since there is no sanitary facilities such as toilets and safety water taps, possibility to be forced to close the market by Ministry of Health can not deny. In fact, Naromoru market in Nyeri District had been closed since 1996 by that reason.
- xvii) Since there is no measure of the brand as Meru Produce through the market, the outflows are limited though the produce of root crops are very popular in taste in Nairobi markets.
- xviii) The market become a hotbet of street children.
- xix) The subsidy for rehabilitation of the market can not be received from the central government to Meru Municipal Council.

d) Agricultural Credit

Most of the farmers in Nkunjumo Area are categorized as smallholders which don't have capital similar to the other three Project Areas. It was known on the result of the farm economic survey that farmers don't understand well credit system itself. Some farmers are afraid of baring lost their land as collateral by bank, and this resulted in never having access to credit service by banks. Capital for farm management by a short term credit is necessary for smallholders if they lack money to buy fertilizers and seeds. Though there is demand for agricultural credit, farmers have hesitated to utilize credit because of intricate application procedure, high interest and necessity for collateral.

The rate of farmers who have the land title is 55 percent. Since there are problems attributing to farmer's side and bank's side in regard to credit services, agricultural credit services by banks, agricultural credit services by banks haven't functioned enough at present despite high demand for it.

e) Farmers' Organizations

There are three categories of farmers organization that are relatively important within the Nkunjumo Water Project Area, i.e: Co-operative Society, Water Users' Association and Women Groups. A summary of problems associated with each category is given as follows;

Summary of Current Problems Facing Farmers' Organizations

Category of Farmer Organization	Main Problems Identified	Potential
Water Users' Association	<ul style="list-style-type: none"> - Group cohesion appeared weak as indicated by late arrival, continuous coming in as well as exit of members during workshop sessions - Committee consists mainly of old men with no representation of either women or young people 	<ul style="list-style-type: none"> - Offers an opportunity for collective action for harnessing water for irrigation and domestic use - Providing a focal point for promotion of and training on irrigation skills
Cooperative Society	<ul style="list-style-type: none"> - Relatively high cost of running coffee factories - Low cherry pay-out/kg compared to neighboring factories 	<ul style="list-style-type: none"> - Promoting saving and issuance of credit - Stocking farm inputs
Women Groups	<ul style="list-style-type: none"> - Loose organizations established for short maturing benefits (e.g. purchasing utensils) and hence not geared to perusing goals that take long to realize - Often not permanent and some stated to last for 6 months only - Weak financial management skills 	<ul style="list-style-type: none"> - Opportunity for getting insight into women preferences and priorities in relation to proposed irrigation project - Basis for production/marketing groups and women-oriented extension packages

f) Agricultural Extension Services

Extension support services by the Ministry of Agriculture is expected to be readily available to the project farmers. In practice, however, it is not and as the project chairman put it "we do not see them".

There are considerable problems that are currently constraining MOA in providing agricultural extension support to the project community as summarized as follows;

Problems and Potential of Providing Extension Services

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

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

g) Water Resources

- Authorized water for irrigation does not meet actual requirement

h) Irrigation and Drainage

- Irrigation plan was not properly established
- Existing pipeline system has not enough capacity to meet the present water demand
- No consensus within the scheme members on water management
- Lack of extension service to farmer on irrigated agriculture

i) Agriculture and Rural Infrastructure

- Shortage of water for irrigation because pipeline capacity is not sufficient.
- Sprinkler irrigation needs more water pressure at the upper reach.
- Existing pipeline needs stop valves at division points.
- Domestic water is not treated.
- Water storage tanks are required to supply domestic water to the secondary school and youth polytechnics.
- Village/farm roads need rehabilitation at sections where hollows and gullies are found.
- There is no electric power supply in the Area.

j) Farm Economy

Average household income in Nkunjumo Area is estimated at 46,200 Ksh which corresponds to about 6,200 Ksh per capita. It is clarified that living standard in this Area is under the poverty line of Kenyan rural areas in comparison with the result of the farm economic survey. The causes are; small farm size, concentration to coffee cultivation, low productivity of coffee. Other than these, there are reasons being attributed to farmer's capability and poor agricultural extension service.

Under the conditions, farmers answered in the farm economic survey conducted by the Study Team that the serious problems to be ranked in order are; i) irrigation water shortage, ii) high cost of inputs, iii) credit service, iv) low crop price, v) poor bargaining power of farmers.

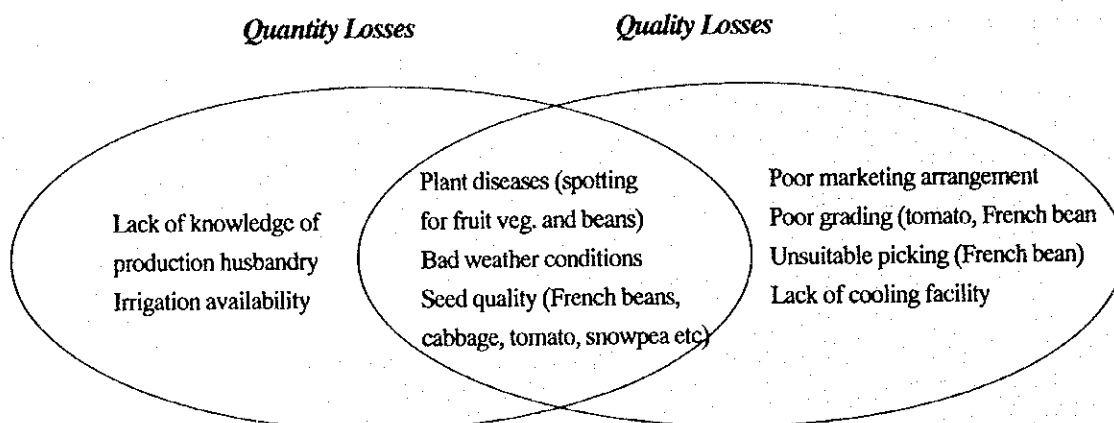
The highest expectation to irrigation facilities is similar to that of other three Project Areas. Though the impact of constructing irrigation facilities will strongly affect on farm economy, various supports in hard and soft-aspects must be done to realize expected effects like increase of family income. There is a lot of things to be done and learned by the beneficial farmers and their organizations.

k) Animal Husbandry

The cattle population is fed on a mixture of gathered crop residues, weeds, fodder grown on the coffee terrace edges and grazing. The land area available for use as pasture is limited already, and expansion of the irrigated area will likely reduce it further. The availability of labour to collect the fodder, clean out the animals and milk them is also another limit to any expansion of dairy production.

l) Post-Harvest and Agro-Industry

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



The agro-industry in the Project Area is the coffee factory for pulping cherries. There is no serious problems for the facilities physically, but some member farmers are selling to other private coffee millers. The application of CAPS is desirable for advance payment.

m) Environment and Rural Life

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

According to the Problem Analysis of PCM, the problems shown by farmers was insufficient food for home consumption.

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

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

2) Development Potential

a) Crop Production

The expanded availability of irrigation water means that there will be a potential opportunity to improve the existing standard of husbandry in the coffee, and thus increase the yields as well as extend the harvest period. There is a limited amount of flat, unshaded land available for intensive vegetable production. Provision of an expanded supply of irrigation water will allow the increased production of coffee, food crops for home consumption and a few crops for sale.

b) Marketing

Close distance to Gakoromone wholesale market and Nkubu market

The distances from the Project Area are 6km to Gokoromone and 15km to Nkubu. The Gakoromone wholesale market has second largest trading volume in Central and Eastern Provinces estimated at 380 ton/day following Karatina wholesale market in Nyeri District. Nkubu market has smaller scale of trading volume estimated at 20-50 ton/day, and the limited triangular space makes difficult farmers' selling their produce due to occupation by retailers. Gakoromone wholesale market is just open space and has not been facilitated yet.

Geographical advance of Gakoromone wholesale market

This market is in very important location on agricultural produce distribution from production areas in Meru and Nyambene districts and to consuming areas, which are Embu, Nyeri, Nyahururu Nairobi, Machakos, Maua, Mombasa and Nyanyuki markets, and also northern and ASAL areas of Isioro, Marsabit and Wajir markets. Many traders coming to this market from outside bring market information by mouth-to-mouth, but dissemination to producers is not reached for the time being. Sampling research by market officer with price enumerators of DAO are requested. The market is located at 1km east from town centre, and the demands of Meru town inhabitants are important resources on marketing.

Motivation of horticultural farming for income generation for farmers

The farmers in the Project Area are massively dependent upon coffee cherry production as cash crop. The farm gate prices of coffee cheery are affected by international prices, which rises at 5-7 years intervals. The prices had dropped in 1990-94 and the payment from coffee societies was often not enough to member farmers after deducting farm inputs of fertilizers and chemicals. The farmers understand by experiences that the extreme dependence upon coffee farming is very risky. At present, the farmers want farming diversification shifting to horticultural production, but how to approach on marketing routes is a major task to be conquered.

c) Water Resources

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

d) Irrigation and Drainage

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

e) Rural Infrastructure

- Water supply pipeline system exists although its capacity for irrigation purpose is not sufficient.
- Access roads are in good condition since B6 national trunk road with tarmac surface is crossing the Project Area.
- Village/farm roads are fairly extended in the Project Area although they need improvement.

f) Animal Husbandry

The production of irrigated napier and the increased production of crop residues from the maize and banana crops will allow the existing population of cattle, which is either a pure line or a mixture of improved breeds, to produce larger milk yields and achieve results closer to its genetic potential. The opportunities for increasing the herd size are limited as the majority of the farm land is currently cropped or rough grazing. Increases in the cattle population are not expected to be large.

g) Post-harvest and Agro-Industry

Closed Distance to Nkubu Satellite Depot

The precooling facility shall be constructed at Mkuruine village near Nkubu town under the Horticultural Produce handling facilities Project and implemented and managed by HCDA. The Satellite Depot has functions of initial inspection at site, transport from designated collection points, weighing, palletizing, precooling, transport from the Satellite Depot to Nairobi Horticultural Centre by insulated van trucks and auctioning information dissemination. By the new route of marketing, say marketing alternatives expanding, the farmers in the Project Area can have transacting options to exporters, middlemen and HCDA for export produce. In case of participation in auction, farmers can obtain timely the market prices information, which shall help in the crop planning. The obligations of farmers shall be organising of the marketing group, selection of chairman/vice-chairman/account/auditor, open of bank accounts, grading, weighing, invoicing, recording of all applied chemicals in dates, sprayed crops, names of chemicals and volume.

3.2 Development Plan

3.2.1 Objectives and Components of the Project

1) Objectives of the Project

Current dominant farming type of the Nkunjumo Water Project, which was classified as Type-D in Model Area selection, is production-oriented commercial-based coffee farming with small-scale horticultural crops. Beneficial farmers are requesting that present farming type will be shifted to commercial-based coffee farming with planning the expansion of horticultural agriculture. This project is the proposed scheme, and categorized into moderate to severe area with relatively hard accessibility to Area from main roads, relatively high construction costs per hectare, a little bit low percentage of horticultural cropping.

Under the 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 of 56 ha with provision of new irrigation facilities, improved management of sustainable horticultural farming for a mixture of domestic and export vegetables for both home use and for sale, like cabbage, French beans, maize and potato, and industrial crops farming such as coffee and tea, organization of small-scale farmers of 140 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 organization, 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 infrastructure facilities of small-scale irrigation facilities such as intake facilities, conveyance pipeline with related facilities, and rural infrastructural facilities of 2.5 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' group, cooperative organization, introduction of farmers' capability building programme, etc., and
- To improve the rural environmental and health conditions of the Area by providing rural water supply,

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 irrigated agriculture focusing mainly on coffee and horticultural crops as well as improving and/or providing the necessary agricultural infrastructures and services,
- To raise farmer's capability to manage rural society by providing continuous educational training, and
- To provide Gakoromone wholesale market facilities in Meru town to promote trading activities of horticultural crops, grains and pulses of Meru produce, to improve current exploiting transaction modes between small-scale farmers and middlemen, and to create collection/dissemination system of timely market information in trading volume by crop and trading prices.

2) Components of the Project

The project components for the Nkunjumo Water Project are generally planned as follows;

- Formulation of irrigated horticultural development plan such as land-use, crop selection, and development of animal husbandry, considering the conditions of steep sloping area in topography, well drained clay loam in soil type, and relative high rainfall,
 - Provision of adequate extension services and trial/demonstration farms,
 - Undertaking of animal husbandry development,
 - Provision of educational training on water management, farm management, agricultural credit, marketing, processing, etc.
- Establishment/strengthening of farmers' organization and promotion of agricultural support services,
 - Establishment and strengthening of farmers' organization (irrigation groups, cooperative societies, women's groups, marketing groups, etc.)
 - Provision of educational training on group management, marketing, O&M of irrigation facilities,
- Environmental considerations,
 - Establishment of soil conservation measures, training on appropriate utilization of agricultural chemicals including the system of maximum residue levels (MRLs), and rehabilitation and protection of watershed,
 - Environmental monitoring and evaluation
- Development of agricultural and rural infrastructures,
 - Development of smallholder irrigation systems by means of improvement of intake facilities and conveyance pipeline systems, and farm /village roads,
 - Development of rural water supply,
- Development of post-harvest and agro-industry facilities,
 - Provision of agricultural equipment, post-harvest and agro-industry facilities focusing mainly on coffee production,

- Social capability building and institutional strengthening programme,
 - Undertaking of village, district agricultural office (DAO) and other local agencies consultations,
 - Formation of technical working committee (TWC),
 - Social preparation for the communities,
 - Strengthening of institutions of IDB and other local agencies,
- Improvement of market facility
 - Construction of Gakoromone market facility in Meru town
- Monitoring and evaluation of the project
 - Irrigation system operation
 - Access and village/farm roads maintenance
 - Agricultural aspect
 - Institutional aspect
 - Marketing aspect
 - Farm economic aspect
 - Control of soil erosion and watershed management

Figure 3.2-1 indicates the development concept to attain overall goals of the Project, which was formulated based on the study results so far made.

3.2.2 Community Capability-Building up and Institutional Development Plan

Effective participation of the beneficiary community, in all the stages of the project cycle, is crucial if the project is to be successfully implemented and sustained. Already, as part of the feasibility study, the local community participated in a one week workshop which analyzed problems as well as objectives and defined a preliminary project design for implementing their project. It is now planned to increase the capability of the local community to undertake the following project tasks:

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

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

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

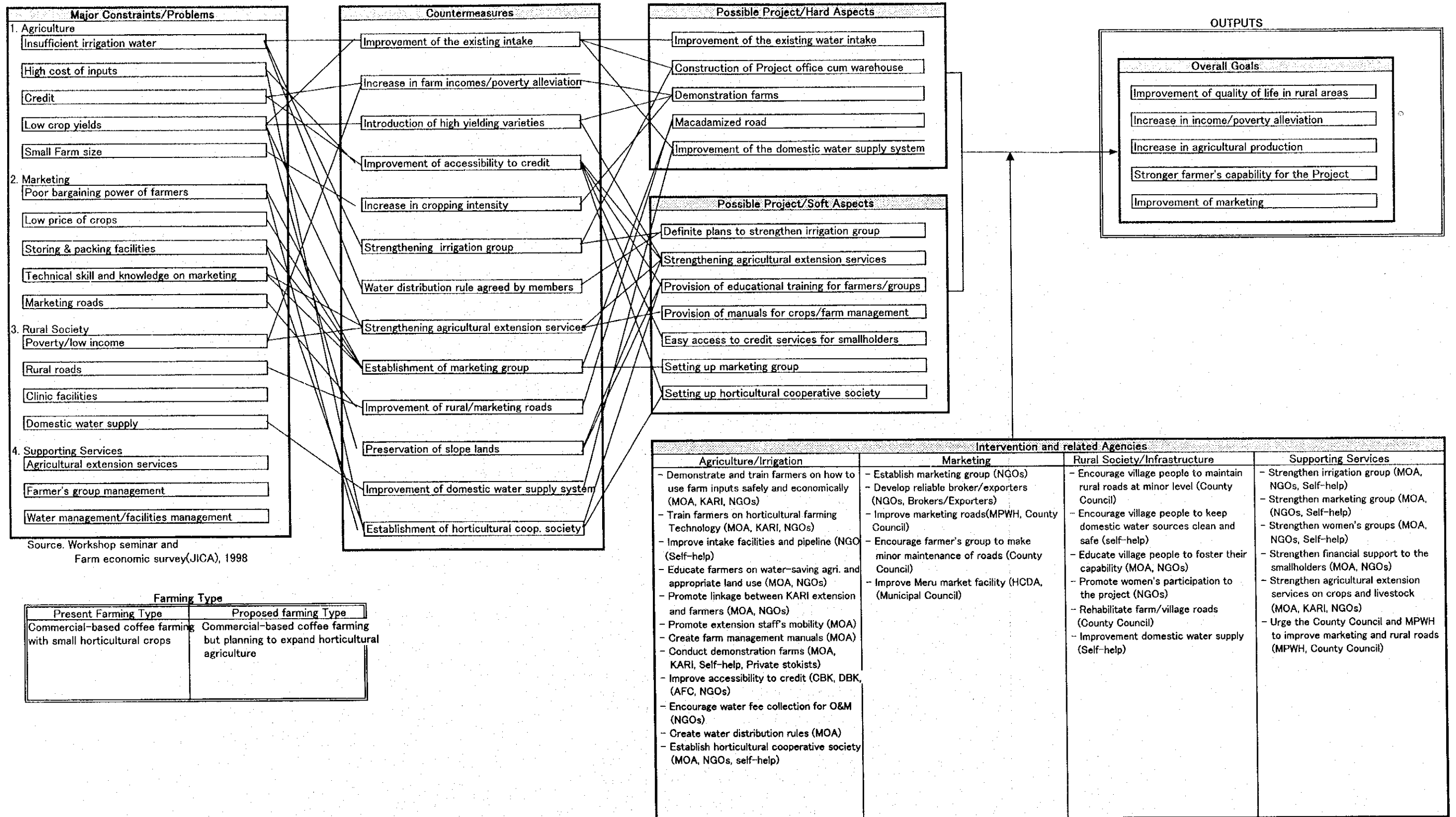


Figure 3.2-1 Relation between Hard and Soft Aspects to attain Overall Goal

