

4. Motivation program to smallholder irrigation schemes (SIS)

- Effective implementation, demonstration and monitoring of "Community-Based Smallholder Irrigation Development Project for Promotion of Horticultural Production in the Foothills of Mt. Kenya" by IDB staff and JICA
- Effective adjustment and coordination with related similar smallholder irrigation projects such as "Eastern Province Horticulture and Traditional Food Crops Project (EHTCP)" by MOALD
- Promotion of land survey for smallholder's land holdings by District Land Office, MOL
- Lowering and easing the loan conditions for development of smallholder irrigation schemes by MOALD and financial agencies such as CBK, DBK through discussions with financing agencies (Co-op Bank of Kenya, Development Bank of Kenya, and others)

5. Water resource allocation program in the basin

- Review of existing water permits (location, permitted water, actual water abstraction, and method of water intake) by District Water Office (DWO), MLRRWD and MOALD
- Study for water resources development in sub-basin mode by DWO
- Review of Water Act (strengthening of control power and improvement of water charge systems) by MLRRWD
- Coordination of water use within sub-basin schemes by DWO

6. Water management program at farm level in smallholder irrigation schemes

- Rehabilitation and construction of new irrigation facilities by the community under technical assistance of IDB staff and private sector
- Review of District Irrigation Profile (location, Irrigated area, water requirement, and facility conditions) by IDB, MLRRWD and other staff relevant agencies as well as local communities
- Promoting establishment of WUAs by MOALD, NGOs and private sector
- Strengthening of WUA by MOALD, NGOs and private sector
- Preparation of guidelines for water management by IDB staff, NGOs/private sector

7. Agricultural support services/extension and credit service program

- Supporting and encouragement of private sector involvement in smallholder irrigation by IDB staff
- Provision of NGOs/private sector with access to technical and market data for distribution to smallholders by IDB and Marketing Information Branch (MB) staff in MOALD
- Strengthening of credit operation procedures of financial institutions
- Initiation of on-farm demonstration by MOALD
- Improve horticultural information through use of KBC
- Improve the mobility of MOALD field staff

8. Farm management and crop production program

- Identification of key constraints by crop and development and dissemination for solution by MOALD
- Development of irrigation crop production guidelines by MOALD
- Review of opportunities for agricultural processing by MOALD & private sector
- Provision of profitable models of farming suitable for young farmers by MOALD
- Production scheduling in relation to market prospects by MOALD

9. Access and village/farm improvement program

- Regravelling, rehabilitation and reconstruction of access roads and village/farm roads by MPWH, District County Council and local community

10. Gender Issue program in the community

- Adoption of participatory approach by MOALD in respect of gender issues
- Formulating explicit technical packages that will be gender-friendly, e.g. irrigation design and cropping patterns including crops controlled by women by MOALD
- Provision of institutional mechanisms for permitting women to access relevant information and technology by MOALD
- Encouragement of change of negative traditional attitudes towards women among communities by Department of Culture and Social Services and other relevant agencies

11. Marketing systems improvement program

- Training on how to gain access in market information by MOALD/HCDA for local and export markets
- Improvement of availability of marketing and price information by Market Information Branch, DAO
- Training of market groups on financial and general management by MOALD in collaboration with NGOs and the private sector
- Training in contract preparation and bargaining skills by MOALD/HCDA and others
- Development of storage for key crops by farmer's group with the assistance of MOALD
- Training and encouragement of processing and utilization of market surplus by MOALD, NGOs/private sector

12. Rural infrastructure improvement program

- Rural water supply improvement by self-help group with the assistance of NGOs
- Effective coordination with related rural water supply projects such as "Rural Water Supply Program in Tharaka Nithi and Meru District" by SIDA and self-help group
- Development of other supporting infrastructure e.g. roads, electricity etc.

13. Rural environment improvement program

- Development of afforestation program by Forestry Department, MOALD and others
- Reduction of chemical hazards by farmer's group with the assistance of Department of Environment, MOALD, KARI, KEPHIS, etc.

14. Population control program

- Encouragement of family planning in rural community by District Health Office (DHO), MOH

11.2.2 Establishment of Development Goals/Strategies and Delineation of Target Groups

1) Objectives and Targets of Development Plan

The objectives of the Study are to improve the farm economy of smallholders who mostly produce agricultural crops and account for 98.7 percent of the number of farm households in the Study Area, through the implementation of improvement and/or construction of small-scale irrigation schemes. The Project implementation will also contribute to both economic growths of the region and the country. The Study Area is known as a horticultural crop-producing area and contributes to earning foreign currency through exports of the horticultural crops. Therefore, the Area will be an important area for the Kenyan economy in the future too.

In spite of great contribution to the regional economy by smallholders, particularly in producing horticultural crops, their monthly income of about 6,900 Ksh per family is lower than that of urban areas and about 8,508 Ksh of average rural income of the country. In addition, about 37 percent of the population and about 30 percent of households in the Study Area are compelled to live on an income level lower than the poverty line.

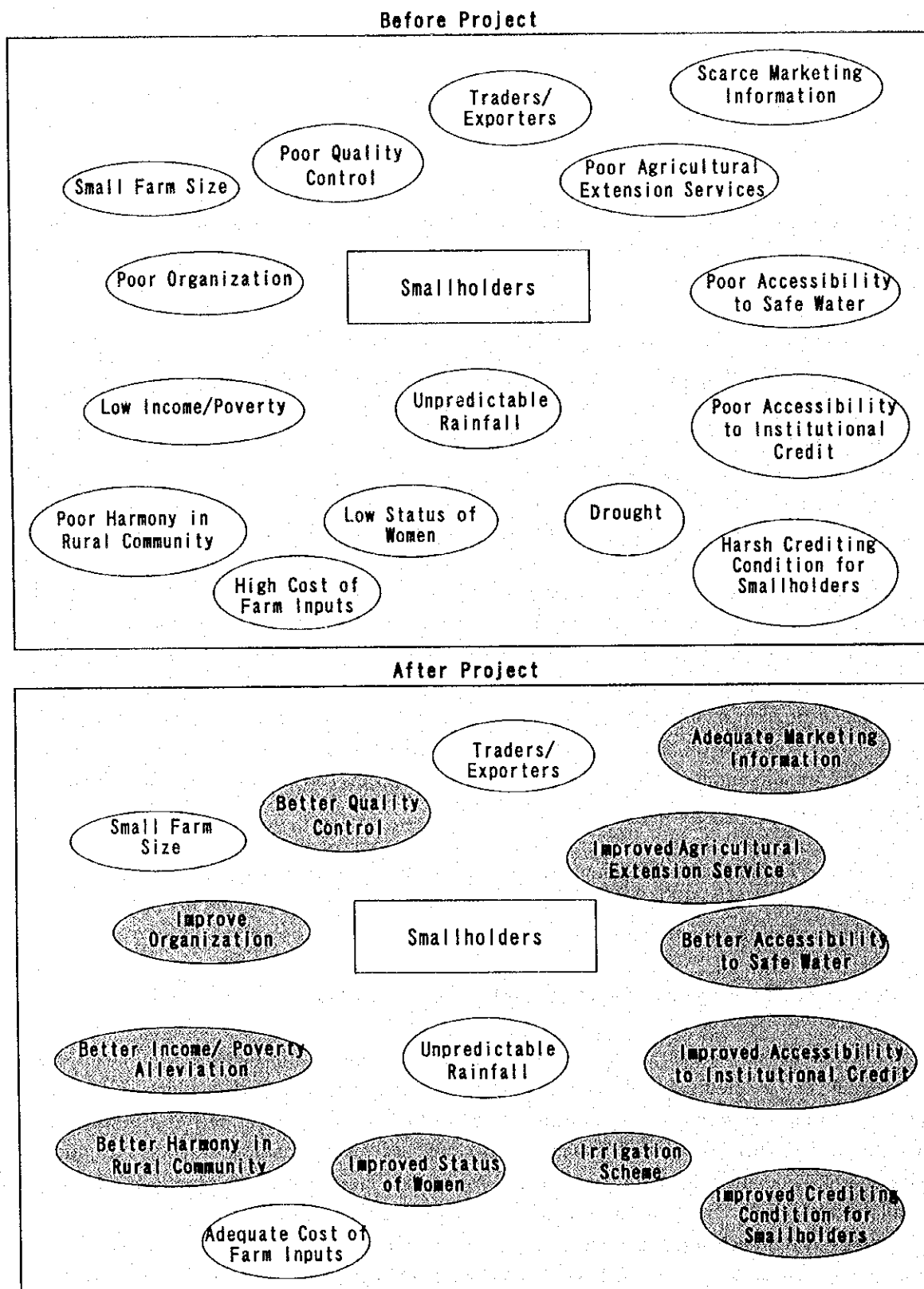
Under these conditions, however, there exist many factors and subjects surrounding smallholders as stated in the problem analysis described previously. Some factors could be improved by implementing the small-scale irrigation project, but others could not be improved even by the project implementation. For example, small farm size, which is a major factor causing poverty, could not be improved. But effective land use (i.e. increase of cropping intensity) and increase in crop yield per hectare could be possible by the irrigation project, and these will result in improvement of farm income, poverty alleviation and lifting up regional economy, and the project will generate solidarity in the community, which will be indispensable in managing irrigation facilities by farmer's groups and in marketing horticultural crops, and improved agricultural extension services and so on.

Figure 11.2-2 shows the comparison of various factors surrounding smallholders in case of between "before project" and "after project". Those factor corded by mesh are ones which could be improved by the project implementation.

2) Development Strategies and Target Groups to Achieve the Objectives and Targets

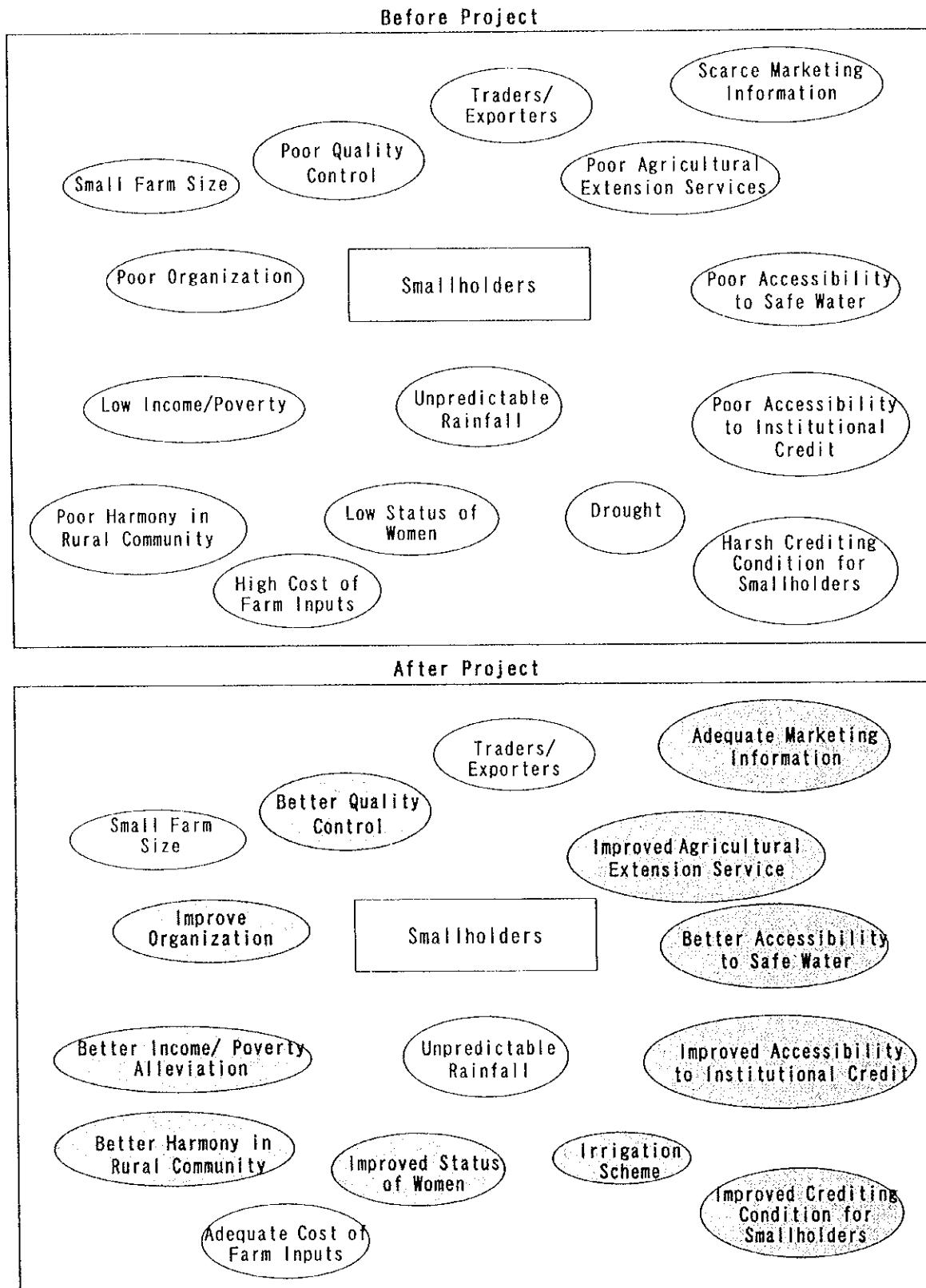
As shown in Figure 11.2-3, factors which compose major constraints and problems of the Project could be largely divided into four groups, that is, a) agriculture, b) marketing, c) rural society and d) supporting services, and some countermeasures to solve these constraints are shown as well. Then possible project intervention (components) composed of hard and soft-aspects are proposed taking into consideration that both hard and soft-aspects are indispensable to attain expected project benefits and targets. Some countermeasures will be necessary, not a single countermeasure, in order to improve a certain constraint, and then some possible project components will be planned to attain the countermeasures, and finally goals could be attained through those procedure as shown in Figure 11.2-3.

Figure 11.2-2 Comparison between Before and After Project



● : Expected to be improved with the project.

Figure 11.2-2 Comparison between Before and After Project



: Expected to be improved with the project.

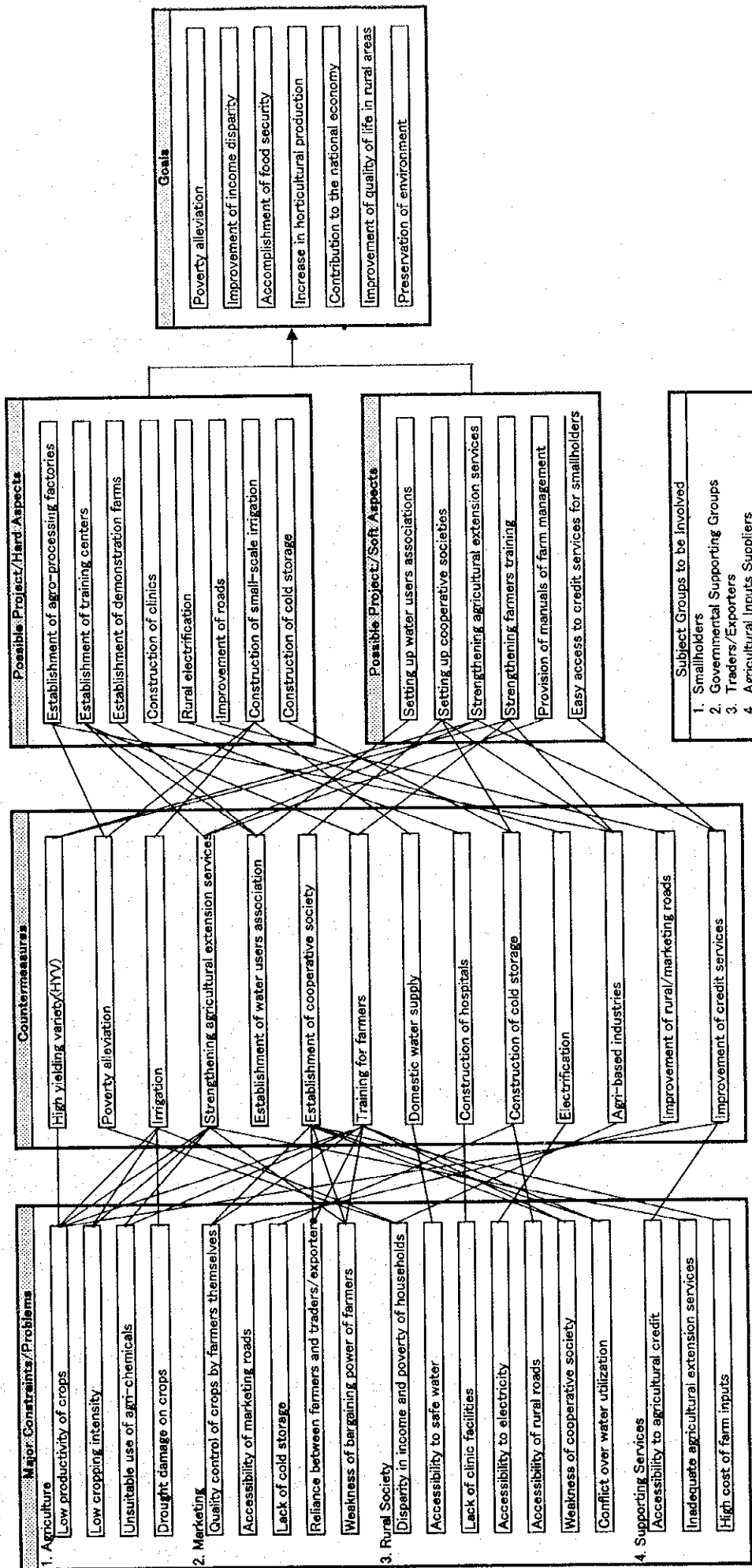


Figure 11.2-3 Relation between Soft and Hard Aspects to be Planned

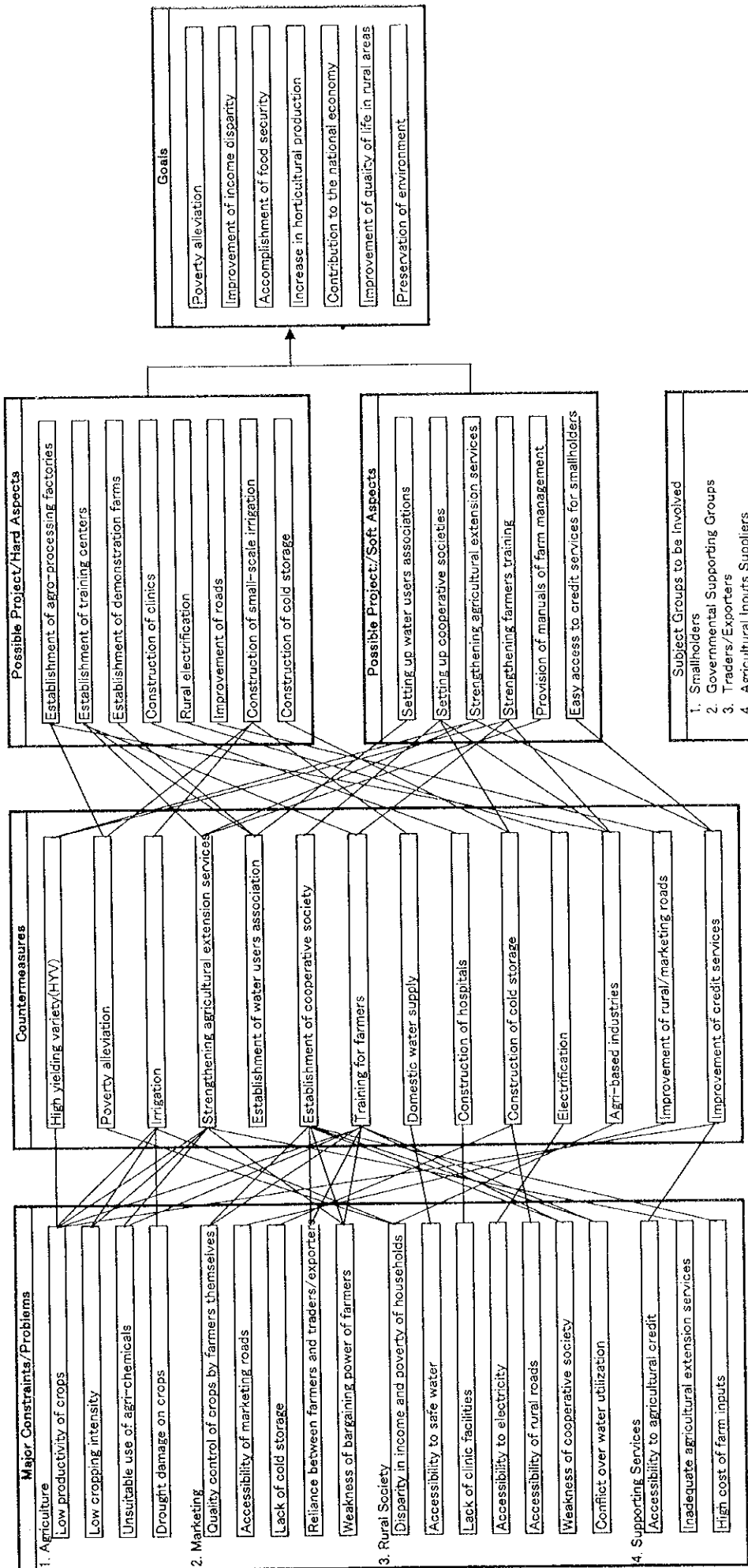


Figure 11.2-3 Relation between Soft and Hard Aspects to be Planned

As stated in the paragraph of stakeholder analysis, target groups which should be involved in the Project will be, a) smallholders who are beneficiaries of the Project, b) governmental groups supporting smallholders in horticultural farming, c) traders/exporters dealing with export-oriented crops in the Study Area, d) the private sector dealing with supplying agricultural inputs, etc. Intensive horticultural farming by smallholders under irrigated condition will be realized through the systematic and mutual activities among those groups.

11.2.3 Establishment of Development Target for Promotion of Horticultural Production

1) Irrigated Horticulture Crop Production Plan

a) Predicting Production Increases

The following assumptions and predictions have been made about the crop areas and production in the Study Area throughout the life of the project.

- In the industrial crops, the total area is likely to remain at approximately the same, or decline slightly. Tea is expected to increase in area, as farmers are encouraged to plant their steeper land to this crop, tobacco will also increase in area slightly, as irrigation expands, while coffee will probably remain at approximately the same area in future. Without major changes in the industry the area under cotton on the other hand will continue to contract. The land released from cotton production is likely to shift to food crops, i.e. cereal and legume production.
- The total area under export crops is likely to increase, mainly through an increase of the areas under macadamia, which is expected to continue to expand as an intercrop with coffee, a large increase in the area under snowpea is expected, and a small increase in the area under Asian vegetables. New crops are likely to be grown on a small area. French beans on the other hand are likely to remain stable or even decline in importance as a small scale farm crop.
- The area under food crops is expected to increase as the increasing population and the smaller farm sizes cause shifts from cash crop to food crop production. Among the food crops maize and beans are more than likely to increase, while the area under other legumes with lower yields is predicted to decline.
- The area under vegetables is likely to increase slightly, or remain the same. Potatoes and cabbages, with their capacity for large yields combined with storage are likely to increase in importance.
- The area under fruit is likely to increase, primarily due to increases in the area planted with bananas.

The following assumptions have been made about yield increases for the calculation of the increase in production caused by full implementation of the program of activities outlined above.

The yield of maize and beans is not likely to increase sharply, as the primary focus of the project is on irrigated horticulture. One source of a yield increase in these crops will be the

increased access to inputs in the Study Area, another is that it is likely that some of the new and rehabilitated irrigation area will be used to irrigate maize and beans. In the Mitunguu irrigation scheme presently only 33 percent of the irrigated area is being used for Asian vegetables and French beans, the rest is under food crops; maize and beans (16%), bananas (23%), sweet potatoes (10%), a wide range of other food and cash crops (18%). It is likely that this trend of irrigating food crops will continue.

b) Increases in Production at Full Implementation

In future under the full implementation, it is proposed to have built new irrigation systems on 6,709 ha, and to have rehabilitated systems of 4,774 ha, making a total potential irrigation area of 11,483 ha. The 5,800 ha of irrigation at Mwea have not been included in the calculation. If we assume that the entire irrigation area is fully developed in future, we can calculate the increases in production of maize, beans and horticulture including potatoes and bananas, as shown below;

Potential Increases in Crop Production

Crop	Increase in Production expected with given Assumptions
	(ton)
Rainfed maize	20,000
Irrigated maize	1,700
Rainfed beans	10,000
Irrigated Beans	650
French beans (Irrigated)	9,250
Asian vegetables (Irrigated)	1,000
Bananas (Irrigated and Rainfed)	42,000
Potato (Irrigated and Rainfed)	46,000
Cabbage	13,000
Tomato	23,000

The above table has been calculated using the following assumptions;

- That area actually irrigated for full development will be 85 percent of the total area.
- That annual export crops will be grown on 10 percent of the total area irrigated.
- That bananas will be grown on 25 percent of the total area irrigated.
- That other fruit crops will be planted on field boundaries.
- That a root crop will be grown on 25 percent of the area irrigated.
- That domestic vegetables will be grown on 20 percent of the irrigated area.
- That maize and beans will be grown on 16 percent of the irrigated area.
- That a variety of other crops will be grown on four percent of the irrigated area.

Another source of increased production is the improved rainfed farming in the area. Assuming that the total area farmed does not increase significantly from the current 700,000 ha, and if we assume that 200,000 ha of that area are under maize and 165,000 ha under beans, a yield increase of 10 percent over the life of the project will give increases in production of at least 20,000 tons of maize and 10,000 tons of beans.

2) Marketing Plan for Horticultural Produce

The target of the marketing plan for horticultural produce is to increase farmers' return or, in another words, to improve the marketing system. In order to achieve this objective, the following aims, which have been derived from the results of project cycle management (PCM) mentioned previously, have to be achieved. In the marketing plan, road development and farmers' organization plans should be analyzed under close relationship.

a) Better Linkage between Demand and Supply

- Information available for the farmers
Information regarding marketable variety, production technique, seed supply, pesticide, fertilizer, MRLs, buyers, grading, storing, market demand in volume and quality, weather forecasting and transaction skills, etc. are desirable for farmers. Repeated extension services can solve the farmers' requests. Since governmental extension activities become restricted due to financial problems, the training of NGOs staff or pay-basis extension services are likely to be needed.
- More storage options in production areas
The charcoal storage is recommendable, which can achieve 5-10°C lower temperature than ambient one in the day time. For this store, water for evaporation and simple management skills are required.

b) Reasonable Margin for Middlemen

- Information available for the farmers
As mentioned above.
- Reasonable transport costs
Improved transportation system is required

c) Improved Access to Markets

- Improved transportation system
- Improved marketing channels
Currently, farmers have marketing channels through middlemen contracted with exporters, independent middlemen, exporters' depots, collecting points by exporters' arrangement, direct sales in markets, retailers in markets, retailers at roadside shops, direct sales at roadsides, outgrowers (cum middlemen) and among communities. Each farmer has a limited alternative to sell produce, and their margins are very low in most cases. In order to improve marketing channels, farmers need to know prevailing prices. Direct or consignment sales in improved markets equipped with cold storage to price fluctuations and auction participant established by OECF project (Horticultural Produce Handling Facilities Project) can be an option to attain the farmers' margin. Provision of farmers' information to buyers; kinds of crops planted, harvesting days, volume, offering prices and location, can all create wider marketing channels.

d) Strengthened Farmers' Capability

- Increased loyalty
This has been lost in previous organized cooperatives. The marketing groups are required for small units of organization among people, who know each other and transparent money handling. Sustenance of reliable relation in groups is the key issue on marginal marketing.
- Equal partners in transaction
The unequal partnership between farmers and middlemen is caused by ignorance of prevailing prices for farmers and collusion of middlemen. Creation of a well-organized community is essential for transaction of crop market.
- Diversification of marketing outlet
This is related to improved marketing channels.
- Reducing risks to export produce
Consumption of Asian vegetables such as karella, aubergine, ravaya, duhdi, tindori and turia is limited in domestic markets. The lesson from rice marketing indicates difficulty in changing eating habits of Kenyans, though rice consumption is reportedly on the increase. The market demand for exports and its price fluctuation can be improved by operation and dissemination of auction prices under OECF project mentioned above.
- Increased competition among buyers
This can be solved by improving the network between farmers' groups, but it is difficult in isolated areas due to the limited number of middlemen visited. This issue is related to road the improvement. Another approach for export produce is to participate in the auction system, but grading techniques and production to meet the fluctuation are required.

e) Improved Access to External Production Information

- Market Information Branch, MOALD is the most important stakeholder for collection and dissemination of market prices of produce. The feasible and fastest method of dissemination is the KBC radio programme, not newspapers. It is recommended that prices in markets in all 16 districts and weekly market review stating trends and trading volume in each market will be announced. Farmers can negotiate with buyers and plan cropping patterns and harvesting day based on this information.

3) Rural Community Plan

a) Background to Rural Community Plan

The history of smallholder irrigation in Kenya has witnessed a progressive shift from total government or donor support for irrigation infrastructure on a grant basis to the situation today when MOALD's approach is based on cost-sharing and cost-recovery. However, old habits take time to disappear and rural communities still regard development projects to be primarily the responsibility of Government or donor agencies.

b) Objective of Rural Community Plan

The objective of the rural community plan will be to empower communities within project sites so that the communities become active partners in the development process. This will be done at two levels: at the wider community level where communities within the project site will be prepared to take a broader and deeper responsibility for their development; at the farmer organization level where different farmer groups and associations will be trained to perform more efficiently the functions for which they were established.

c) Community Preparation Sessions

Community preparation sessions should be conducted through a series of participatory rural appraisal (PRA) sessions in all seven districts covered by the Master Plan. MOALD will be expected to coordinate community preparation efforts. This will entail holding about one week briefing workshop in each district with representatives from agencies whose work is relevant to the project site communities. Such agencies will include government and para-government organizations, County Councils and associated urban authorities, local NGOs as well as the private sector. The purpose of these briefing workshops is to clarify their plans and commitment in the Study Area and to invite their participation in the community preparation sessions.

d) Training Support for Farmers Organizations

It is planned to implement a training program aimed at strengthening existing farmers' organizations and promoting establishment of new ones in the seven districts of the Study Area. The training will be aimed at imparting skills to ordinary members as well as management committees in a broad range of fields including organization and management for water distribution, crop marketing and sourcing of development and input credit.

The training should be conducted at the project site level and will be conducted after the general community preparation session. Targets for training support are proposed as presented below;

4) Agricultural and Rural Infrastructure Plan

Agricultural and rural infrastructure under the Project consist of irrigation and drainage facilities, access roads, farm roads and water supply facilities. In order to support irrigated horticulture and marketing development, targets for agricultural and rural infrastructure plans should be established as follows;

- To improve/expand irrigation and drainage facilities with maximum utilization of available water resources. Facilities shall be small-scale, with simple operation and easy maintenance in consideration of the operation and maintenance by beneficiary farmers.
- To provide passable access roads to irrigation schemes during wet seasons. These roads function as farm-to-market roads as well as village access roads, therefore community initiative/involvement shall be considered in the O&M of access roads.

- To provide adequate level of farm roads to transport input supply and produced crops in the area.
- To provide safe water for domestic use for the improvement of living conditions. Surplus labor force created from the improved/established rural water supply system can be used for agricultural production.

5) Environmental Aspects

Following environmental aspects will be considered throughout all aspects of the Project so as not to induce any adverse impacts on the natural and social environment.

- Soil and water conservation in the catchment area is the most important issue for the Cosustainable agriculture in the foothills of Mt. Kenya. It will be effective to combine the project with the conservation program being executed by the Soil and Water nservation Branch of MOALD.
- There is the possibility of deterioration of water quality of rivers by the increase of population, livestock, and use of chemical fertilizer and agro-chemicals. River water is use as drinking water without treatment in many areas. Improvement of the quality of river is important for the habitants in downstream area including Nairobi.
- Damage by wildlife and increase of diseases by Malaria and Amoebiasis should be also considered in the Project since these diseases are related with water. Some farmers answered to the question by the Study Team that water-borne diseases are increased after irrigation farming was implemented.

CHAPTER XII.

FORMULATION OF BASIC DEVELOPMENT

MASTER PLAN

CHAPTER XII. FORMULATION OF BASIC DEVELOPMENT MASTER PLAN

Basic Irrigated Horticultural Development Plan for the Project will be formulated subsequently with the following subjects, in accordance with development goals and strategies mentioned in Chapter XI.

- Examination of Project Justification
- Horticultural Development Plan
- Marketing Development Plan
- Institutional Development Plan
- Community Development and Farmers Organization Plan
- Irrigation and Drainage Plan
- Road Development Plan
- Rural Water Supply Development Plan
- Environmental Conservation Plan
- Operation and Maintenance Plan
- Project Implementation Plan
- Improvement of Socio-Cultural Situations

12.1 Examination of Project Justification

12.1.1 Contribution to Regional and National Plan

Government of Kenya is now promoting the 8th National Development Plan for 1997 to 2001, which aims at annual economic growth of 5.9 percent and agricultural sector growth of 4.4 percent. The major targets of the agricultural sector are below;

- To attain food security
- To strengthen agri-based industries,
- To strengthen cooperative societies,
- To develop commercialized agriculture,
- To improve production of export-oriented crops and industrial crops,
- To improve livestock and to increase animal products,
- To increase crop yield and to diversify cropping through irrigation,
- To develop rural areas,
- To develop ASAL areas,
- To improve management of information relevant to agriculture.

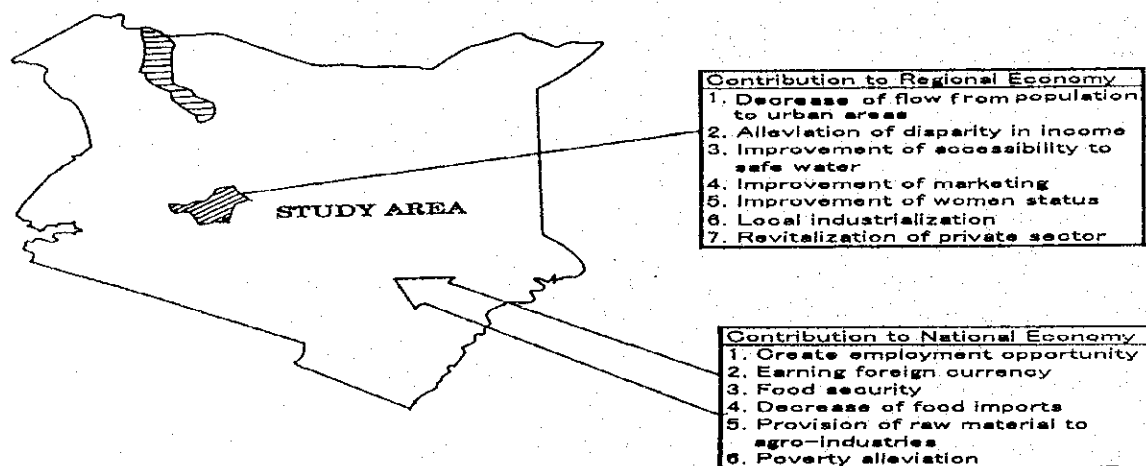
The purpose of the Project, aiming at small scale irrigation for smallholders, is in line with the national targets mentioned above, that is;

- To increase export-oriented horticultural crops by introducing irrigation,
- To develop commercialized farming by smallholders,
- To improve rural water supply by using irrigation facilities,
- To establish and to strengthen cooperative societies, and
- To increase the food crop production through strengthening agricultural extension services.

Production of export-oriented horticultural crops by smallholders will directly contribute to the national economy in earning foreign currency.

Though the Study Area accounts for only 2.75 percent of the national land area, irrigation development in the Area will be a good example not only for designing irrigation projects suitable for the Area but also for indicating necessary activities such as supporting and capability of beneficiaries to manage irrigation facilities and organizations to attain project objectives.

The targets of the agricultural sector of the seven (7) districts concerned in the Study Area are, a) to increase coffee and tea production, b) to attain self-sufficiency of food, c) to contribute to the national economy through increase of horticultural crop production in food security, poverty alleviation and promotion of employment etc. For this purpose, development of intensive farming through training of farmers is required in the district development plan for 1997-2001. In this Study, intensive agriculture for staple and horticultural crops and a definite program for farmers training and strategies for strengthening agricultural extension services are proposed which will contribute to promoting regional development policies aiming at developing seven (7) districts focusing on the agriculture sector. In particular, this Study is in line with regional development plans in, a) introducing irrigation, b) improvement of marketing information for farmers, and c) organizing farmers for better marketing. The Project will also contribute to the regional plans in providing a good case of small-scale irrigation projects to attain targets. In addition, improvement of rural water supply, which will be accomplished with the implementation of irrigation facilities, will contribute to reduce female and children's heavy work loads fetching water.



12.1.2 Assessment of Typical Household Economy

In order to verify the Project's impacts on farm economy, farm household incomes in the cases of "without" and "with Project" will be compared, which is called financial analysis and differs from the economic analysis calculated by using economic prices from a national economic point of views. Therefore financial prices which are not processed will be used to analyze the farm economy from an individual farmer's economic point of view.

Farm management type and farm size in the Study Area differ considerably among districts. Particularly, farm size of so-called smallholders ranges from less than one hectare to up to 20 ha. Therefore, it will be necessary to analyze farm economy taking into account some farming types. For example, a) farmers mainly planting horticultural crops, b) farmers mainly planting food crops, c) farmer managing both animals and crops will be analyzed in varying farm sizes.

Then, cost recovery will be analyzed to study the capability for amortizing the project costs which is required to burden on farmer themselves on basis of SIS concept. In this study, some studies will be done by changing interest rates, repayment periods and ratio to be burden by farmers, in addition to present credit conditions for SIS. Depending on the results of this analysis, in which smallholder farmers might be considered not eligible for amortizing under current credit conditions, some alternative credit condition (interest rates, repayment period, and ratio and part of project cost to be paid by farmers, grace period and subsidy) might be proposed. It is also forecasted that some smallholders with smaller farm size could not pay for amortizing. In analyzing cost recovery, off-farm incomes and expenditure will be taken into consideration in addition to farm incomes.

12.1.3 Technical Viability

1) General

The proposed plan consisting of broad-based irrigated horticultural development around Mt. Kenya aims to strengthen agricultural production, employment and income-generation and to improve the living conditions of rural population in the areas. Namely, the plan will enable higher productivity by utilizing existing and underdeveloped agricultural land, by developing available water resources, and by transferring agricultural technology through the training of regional government staff and beneficial farmers. And also agricultural and rural infrastructures in the areas will be improved thus enhancing the living standards of the rural population.

Overall effects to be derived from the proposed plan consist of tangible and intangible benefits. Tangible benefits arise from an increased value of production, e.g. increased agricultural production by way of a new irrigation system. Valuation of tangible benefits is not difficult in most cases. Intangible benefits, however, cannot be readily measured in a quantitative manner. These may include road improvement, environment improvement, creation of new job opportunities, better health, better nutrition, reduced incidence of water-borne diseases, etc. Although numerical valuation of intangible benefits is difficult, every effort will be made to assess these factors as much as possible.

On the other hand, project facilities such as agricultural and rural infrastructure will be planned with low project costs, considering project and farm economies on the basis of cost-sharing and cost-recovery by beneficial farmers, which are the principal policy of the project planning in the Study.

2) Effects on Agricultural Production

The proposed irrigable area for the whole Study Area will be about 11,200 ha with an

implementation of the project, while present irrigated areas are about 6,900 ha, and it will be expected that an intensive horticultural development plan will have favorable effects by increasing production of vegetables and enabling higher labor productivity.

3) Employment and Income Effects

Overall employment will be raised substantially as a result of more intensive land use, thereby helping to alleviate high unemployment particularly during the dry season. In addition to increased family employment in on-farm activities, hired labor will also be expected to increase. Civil works for the plan will create new jobs for skilled and unskilled labor during the implementation period. After project completion, jobs will be generated by maintenance of facilities, vocational training, etc.

4) Improved Standards of Living

Expansion and improvement of social infrastructure under the project will favorably effect improvement of living standards for the rural population as mentioned below;

- Reduction of labor
 - Improved water supply eliminating need for water hauling
 - Improved transportation saving time spent on travel
- Employment generation
 - Technical training (farmers' training and women in development)
 - Job generation
 - Generation of job opportunities for women
- Health and sanitation
 - Decrease in water-borne diseases
 - Nutrition
- Social Welfare
 - Increase in recreational opportunities by providing village community facilities
- Environment
 - Improvement of rural environment by providing rural water supply
 - Improvement of rural roads

5) Environmental Impact

By providing terraced farmland on severe eroded land and by taking countermeasures for soil and land conservation by means of vegetation coverage, the plan will have an important positive impact on the general environment in the areas. It will also help not only to reduce soil erosion in the farm land, but also to reduce flooding in the downstream areas, recharge groundwater recharge, and to supply fuel wood. By providing access roads from each village to main link roads, the villagers will enjoy a healthy and conformable environment in and around their villages.

6) Other Socio-Economic Impacts

In addition to the effects described above, various socio-economic effects will be expected as described below;

- Higher standard of living for farmers through increased farm production and multiple effects on the surrounding areas,
- Dissemination of improved farming technology to farmers in the vicinity of the areas,
- Improved communication among the rural peoples by provision of improved roads, village community facilities, etc.
- Activation of economic activities by increased agricultural production and inputs,
- Increased job opportunities in marketing services through increased production of horticultural produce.

12.2 Horticultural Development Plan

The potential crops in any location are determined by a number of factors: the climate, especially rainfall and temperature; the soil type; the availability of labor; etc. The optimum crops among the potential crops are determined mainly by the relative factor prices and the availability of markets.

The agricultural year in the Study Area can be divided into four sections according to the rainfall pattern. Basically from March to May rain falls, from June to October it is dry, from November to December more rain falls, and from January to February it is dry again. The amounts, timing and duration of the rain varies by location and by year across the Study Area.

The temperature is a function of elevation, season and cloud cover. The average annual temperature in the Study Area is around 20°C with only small monthly variations. The diurnal variation however can be large and can limit or promote crop production. Diurnal variation increases with altitude. Low night temperatures can promote flowering or limit production at the higher elevations. The bulk of the Study Area is between 1,000 m and 2,000 m.

Although soils and climate are key determinants of the current crops grown, the influence of soil type on the cropping pattern can be largely disregarded, in the formulation of the proposed cropping patterns, as it is assumed that only locations with better soil types will be chosen for irrigation development. There are soil factors influencing production within an irrigation scheme, on the lighter sandy soils, more irrigation will be required, while on the heavier soils crusting may occur, limiting the emergence and productivity of small seeded crops, restricting the bulbing of onions, reduction of efficiency of weeding etc.

The influence of the markets on the cropping pattern are dealt with in another section of this report.

All of the above are technical criteria limiting the choices that a farmer can make. The actual crops that a farmer chooses to grow are determined by a large number of factors; the

information available to him, the available capital, the expectation of profit, the available labor, the other crops/enterprises in his farming system, his perception of risk, etc.

The varied nature of the influences on a farmer's decision making means that determining how an individual farmer will choose is almost impossible to determine. However, in the aggregate there will be some clear trends. The current choices are reflected in the existing trends and areas in the cropping pattern. These can be used to predict the likely use of new irrigation and also to suggest those activities which will be required to change the situation. The existing cropping patterns for the seven districts in the Study Area are presented in the Annex, together with a proposed cropping pattern at full irrigation development.

Besides the direct impact of installing new irrigation and rehabilitating existing systems, and thus increasing the area under irrigated production, development and improvement of the small farmer production systems in the Study Area could lead to a number of different kinds of increases in yield and income. These include;

- Improvements in crop yield per unit area
- Increases in the proportion of total crop production marketed
- More intensified cropping systems
- Improvements in the crop mixture
- Better crop timing to capture market peaks
- Improvements in crop quality
- More and better quality crops for home consumption
- More sustainable use of land

A number of activities are needed to help produce these improvements. A major requirement is to improve the supporting services for agriculture in the Study Area. Throughout the world the role of government agencies in supplying production extension services is diminishing. In Kenya, it is likely that budgets will continue to decline, so a limited role for government is likely and alternative strategies is needed.

The supply of inputs, such as fertiliser and crop chemicals is seen primarily as a private sector activity. Their involvement will be encouraged by the increased agricultural activity throughout the area. This involvement in the supply of improved inputs for farming could be facilitated by focusing new irrigation in close proximity to existing irrigation wherever possible, by providing farmers with training and access to information, thus enabling them to be better informed consumers, and by encouraging specialisation wherever feasible.

NGOs have played an important role in the development of group based smallholder irrigation in the Study Area. They should be encouraged to continue this role. They are likely to be important providers of training services and a cost effective way to mobilise groups for saving, water management, and marketing.

The role of the government in the collection and distribution of price information and in research is likely to continue and, subject to the availability of funds, even expand. There is also the possibility of collaborating with Kenya Broadcasting Corporation in the development of a

horticultural news program, to provide an improved distribution of key price and technical information throughout the area. There is an existing irrigated demonstration farm at Mitunguu which could be evaluated and utilized as a potential training resource.

The provision of key inputs has to be combined with trained farmers and good technical information if increases in production are to be achieved. An initial project activity could be to examine the key constraints on a crop-by-crop basis and to propose, develop and review the available technical information available for each crop. The updating of the existing crop production guidelines could follow. Another early activity could be the assessment of the opportunities for processing in the project area, and suitable forms of on-farm storage, handling and packing.

It is important that sustainable land use practices are encouraged. One way to achieve this is to have an overall soil conservation and afforestation program for the Study Area, with a focus on irrigated agriculture. Training of export crop producers in safe pest control, chemical use and MRL's is essential if Kenya is to maintain its share of the EU market. Another area that needs strengthening is the use of crop and farm budgets to enable good managerial decisions to be made. Particular effort will be made to target women, who are often the actual farmers. These budgets can be used to build models of farming that can be targeted at particular audiences, for example young people entering farming, who are frequently short of land and capital.

Once the production in the area has been improved, improved links between increased supply and demand need to be made. The road development program is one key piece in this linkage. Strengthening the market information branch activities in price collection and dissemination is another. Coordination with the OECF project activities in market development is also required. At the scheme level, groups trained in grading, harvesting, handling, packing and marketing could be encouraged.

12.2.1 District Horticultural Development Plan

District specific recommendations for targeting horticultural development activities follow. Specific targets for the district specific strategies, crops to be focussed on etc. should be developed at the district and/or project level, in collaboration with the local extension staff, and those ultimately responsible for implementing the strategies. The final choices will depend on the resources available. This section includes some illustrative potential activities, more are included in the other portions of the report. The crop focus in most of the district is based on a strategy of specialization. The target is to improve and develop the existing focus of production.

1) Nyeri District

- | | |
|--------------------|--|
| Strategy | : Intensification (small land holdings and population pressure) and specialization (tradition of horticulture in district), improve links to markets (close proximity to Nairobi). |
| Geographical focus | : On Kieni East and Mathira divisions for export production. |
| Crop focus | : Tomatoes, cabbage, onions, potatoes and snow-peas. |

Illustrative Activities : Training, logistical and technical support in drip irrigation, marketing techniques and crop production technology for field level extension staff and farmers. On farm testing, modification and dissemination of improved technologies such as drip irrigation, fertigation, hybrid vegetable seed etc. Field trials of new cabbage varieties, increasing the harvest period and field life of cabbage, snow-pea training systems, etc. Monitoring prices, area planted, yields and production for key crops. Farm and crop budget analysis.

2) Kirinyaga District

Strategy : Intensification (small land holdings and population pressure); specialization (tradition of horticulture in district); improved links to markets (proximity to Nairobi).

Geographical focus : On Mwea division (water available, topography favorable, market access and tradition of production), current small-scale tenant rice farmers on the NIB scheme likely to diversify their cropping patterns, possibly encourage them to consider domestic market vegetables, such as onions.

Crop focus : Bananas, French beans, tomatoes, melon and passion fruit.

Illustrative Activities : Training, logistical and technical support in sprinkler irrigation, marketing alternatives, maintaining quality, and crop production technology for field level staff and farmers. Field trials and demonstrations of profitable out of season production (non-competition with rainfed tomato), crop timing, and profitable rotations. Water management, both on-farm and at the group level, installation and use of irrigation control points in the field. Updating of district crop production guidelines, with issues such as export packaging, MRL's etc. addressed.

3) Mbeere District

Strategy : Mechanisation (larger land holdings and labor availability); develop marketing groups to overcome current lack of cooperation (not a strong tradition of group-based small farmer horticulture in district); need to improve road and transport links to markets (proximity to Nairobi).

Geographical focus : Along rivers (water available), close to the main access roads.

Crop focus : French beans, and Asian vegetables, (large-scale commercial farmers) tomatoes, chillies and melons, (smallholders).

Illustrative Activities : Training, logistical and technical support in marketing strategies and alternative irrigation technologies for field

level staff and farmers. Also in crop timing, cash management and water management, at both the farm and group levels. Encourage groups to bulk buy from input suppliers located in area. Development of a district wide strategy for encouraging horticultural production.

4) Embu District

- Strategy** : Increase utilization (valley bottom land between foothill ridges planted with coffee); specialization (tradition of fruit production in district); improve links to markets (proximity to Nairobi).
- Geographical focus** : On currently under-utilised valley bottoms.
- Crop focus** : Cabbage, French bean, banana, and grafted mango.
- Illustrative Activities** : Training, logistical and technical support needed in nursery establishment and management for improved fruit and nut varieties, plus marketing and post harvest technology for field level staff and farmers. Specific attention to field trials and demonstrations to identify those crops suitable for small areas along the rivers and capital poor young farmers.

5) Tharaka Nithi District

- Strategy** : Increased utilization (land available); improved crop timing (Meru competes, and has longer tradition of horticultural production); improve road and transport links (within district).
- Geographical focus** : Around existing irrigated loci and near the better roads.
- Crop focus** : Cabbages, onions, bananas, and passion fruit, also food crops such as maize and potatoes.
- Illustrative Activities** : Training, logistical and technical support in crop establishment and management, especially the timing of production and product handling, plus horticultural marketing and post harvest technology for district and field level staff and farmers. Support to specialised irrigated horticultural agents in both MOALD and selected NGOs. Trials and demonstrations of a range of potential crops, aimed at integrating horticulture into a diverse cropping system aimed at food security.

6) Meru District

- Strategy** : Build on current economies of scale, (major producer of potatoes etc.); improve storage (gluts); only three hours to Nairobi, long tradition of horticulture.

Geographical focus : The main existing growing areas are; Abogeta West is the major horticultural division, (French beans, carrots, cabbages, potatoes, tomatoes, onions, temperate fruits), Timau (snow-peas, Asian vegetables, tomatoes, garlic, onions, cabbages, kales), Nkuone (Asian vegetables, cabbages, carrots, tomatoes, onions, bananas), Abothuguchi east (French beans, passion fruit, mango, banana), Miriga Mieru (French beans, Asian vegetables, onions, cabbages, tomatoes).

Crop focus : Cabbage, carrot, garlic, snow-peas and bananas.

Illustrative Activities : Training, logistical and technical support in establishing marketing groups, and post harvest technology for field level staff and farmers, especially use of pesticides on Asian vegetables, harvest intervals and dosages. Field trials and demonstrations of high value, low volume crops such as garlic, onions. Encouragement of perennials, such as banana, or napier grass on the steeper slopes.

7) Nyambene District

Strategy : Encourage specialization to increase marketable volumes (limited tradition of production in district); improve links to market information (distance to Nairobi/Mombasa etc.).

Geographical focus : Igembe central, (Kanjoo, Kitheo and Gakunku), Tigania, (Kunati, Marega, and Kiorimba), and Uringu division, (Thanantu valley).

Crop focus : Alternative crops to Meru, which usually has comparative advantage. Chillies, grapes, onions, Asian vegetables.

Illustrative Activities : Training, logistical and technical support in producing crop production guidelines, e.g. planting dates and minimising input use, also in crop marketing and post harvest technology for field level staff. Farm budget and margin analysis along the production and marketing chain, for farmers and extension staff. Measuring and monitoring water use by farmers. Development of a district wide horticultural strategy.

12.3 Marketing Development Plan

12.3.1 Marketing Plan for Horticultural Products

1) Training of Smallholders in Grading, Post-Harvest and Marketing

Desirable information for training of smallholders are;

- **Market information**
Market price information by crop in Meru, Karatina and Nyeri; monthly fluctuation, buyers, provision of farmers' information to buyers, negotiation skills, long-term profit, input information
- **Grading**
Grading techniques acceptable by buyers in color, size, contamination, immaturity, shape, cleanliness
- **Post-Harvest**
Design of charcoal store and grading shed, harvesting method and time, conscious of time to transport to decided collection point
- **Marketing**
Transaction skill and sale timing provided cold storage, participation to auction system

2) Improved Access Road Network in Irrigated Areas

(Refer to 12.7 "Road Development Plan".)

3) Strengthening the Price Collection and Dissemination System in the Areas

- **Collection**
Accurate price collection by training of price enumerators with provision of weighing device, calculators and motorcycles, coordination with county/municipality/town councils to convert amount of collected market cess to trading volume
- **Dissemination**
Improvement of KBC radio program for market information

4) Expansion of Market Information Branch

Establishment of data bank with the following facilities will be needed, that is, renewal of computer system, facsimile, motorcycles, calculators, publication system, training of marketing officers and evaluation of the past project undertaken by The Kenya Market Development Project and coordination with its donor, USAID.

5) Promotion of Marketing Groups in Each Scheme

Training of organizing staff for employment base with provision of motorcycles, or joining a

course in Jomo Kenyatta University of Agriculture and Technology, creation of farmers' incentives in both physical and theoretical approaches referred to in 12.4, Community Development and Farmers' Organization Plan.

- 6) Coordination with OECF: "The Horticultural Produce Handling Facilities Project", as new irrigation is developed

Participation in auction for export produce through Nkubu, Sagana and Mwea Satellite Depots, but it is necessary to organize marketing groups, and dispatch experts for that project.

- 7) Improved Facilities of Major Markets at Nyeri, Karatina and Meru

- Nyeri Market

The municipality council is planning to transfer to Mjinga site, but the retail section will remain in the current site. Future prospect for ways to develop is not clear. Main function of this market is for local consumers in the vicinity of Nyeri town, and produce for outflow is increasing in Karatina market.

- Karatina Market

The wholesale section should improve to meet demands and fluctuation for both local and Nairobi consumers. As a part of the wholesale market, cold storage for cabbage, irish potato, dry bulb onion, green maize, local mango and tomato and normal storage for mwitemania bean and green gram will greatly assist farmers' to achieve a margin. The sale timing and prices must be decided by farmers' group with provision of price data from Market Information Branch and farm management officers in DAO. The management body for facilities can be selected from Town councils, County councils, District Agricultural Offices, users' union of farmers' groups, SACCO, NGOs, private organizations or HCDA. However, governmental intervention in operation and transaction must be minimized because of past experience and the streamlining of ASIP recommendations.

- Gakoromone (Meru) Market

There are no facilities at all, un-leveled, dusty, eroded, no water supply, no hygienic facilities, no option to store and a security problem, but trading volumes are the second largest in production areas in the whole of Kenya following Karatina market. The improved market facility with stores will support farmers' marketing groups, who know the real prevailing prices through direct or consignment sale of produce. Cold storage also helps farmers' margin.

12.3.2 Post-Harvest and Processing Plan for Horticultural Produce

- 1) Construction of Storage at the Farm Level

The storage of grains in farm level is one of significant measures for food self-sufficiency. By the affection of the drought in nearly 1997, the prices of grains except finger millet extremely increased at 167 percent in maize, 260 percent in Canadian wonder bean, 226 percent in Dolichos bean, 260 percent in Mwitemania bean and 247 percent in Rose Coco bean comparing to 1996 averages. The dry beans were not imported even drought season because the prices of Tanzanian

beans also increased. Even in normal years, the seasonal fluctuation of dry beans can not be neglected. In semi-arid areas in lower parts of Meru, Nyambene, Tharaka Nithis and Mbeere the storage of millet and sorghum can alleviate starving situation. The storage plan can be phased according to operation skills of farmers' marketing groups.

- i) Storage by individual farmers.
- ii) Storage by reliable groups.
- iii) Forming grains marketing groups.
- iv) Collection of prices from Marketing Officer in DAO and analysis of 'Commodity Price' on the daily newspaper.
- v) Collection of drought information from Meteorological Stations.
- vi) Setting target storage volume and quota of each member.
- vii) Decision of market outlets for surplus; middlemen, retailers. or direct sale in local/wholesale markets.
- viii) Funding for construction of concrete warehouse.
- ix) Installation of telephone and contact with retailers in markets.

2) Construction of Grading-shed and Charcoal Cooling Store

The sheds for short-term storage, grading and packing for marketable produce such as avocado, cooking banana, ripe banana, cabbage, carrot, green gram, green maize, local mango, spring onion, paw paw, potato and tomato are required, facilities of which can act as loading or buying points. The facilities must be utilized by more than 10 marketing groups. Running water supply is required for hygienic purpose in grading and cooling. The store shall be covered by charcoal and maintain low temperature by latent heat of water evaporation. Boreholes are recommendable.

12.4 Institutional Development Plan

12.4.1 Agricultural Supporting Services

1) Agricultural Extension Services

In providing supporting services to smallholder farming communities, front-line extension staff are presently constrained by lack of transport, inadequate technical extension messages and materials as well as insufficient skills in participatory approaches. While some of these constraints will require far-reaching GOK policy and administrative decisions, others can be countered through a well-considered training strategy.

It is therefore planned to implement a training programme for staff involved in providing extension services within the project sites in the following fields:

- Participatory extension approaches that give special attention to the whole farm system, particularly roles and special needs of women
- Target-setting and results-oriented work-planning of extension activities
- Communication and marketing skills including use of appropriate but inexpensive visual

aids

- Skills in promoting positive group dynamics and group formation
- Design of extension messages based on research/extension linkages including sound catchment management practices
- Participatory rural appraisal and participatory planning techniques
- Participatory monitoring of irrigation schemes and general agricultural performance

Details of specific training modules will be elaborated jointly with GOK personnel.

At the IDB Headquarters, it is proposed to strengthen the existing Project Development Section with a view to giving it a capacity to develop extension and training packages on a continuous basis, particularly for proposed project areas. These packages will then be used for training front-line extension staff in order to keep them up-to-date on changing technical and market requirements of irrigated horticultural as well as general agricultural production.

2) Institutional Collaboration with Ministry of Culture & Social Services

Development projects often require not only technical adaptation by target communities (acquisition of new knowledge and skills) but also significant changes in their social and cultural lives. For sustained project performance, the host community (direct beneficiaries and others) must accept the project as their own and thus integrate it into their daily lives. For this reason, it is proposed to increase the role of the Ministry of Culture and Social Services (MOCSS) so that it can promote required social and cultural adaptations within project communities. At the moment, the role of MOCSS in agriculture is limited to registering community-based self-help groups (women's groups, irrigation groups, water users' associations etc.) with very limited post-registration support.

The Ministry of Agricultural/IDB will therefore be encouraged to work out a collaborating arrangement with MOCSS so that staff members from both Ministries will be involved in various community support activities i.e: community preparation, farmer group formation and holding of annual development performance reviews.

3) Establishment of District Sub-Committee for Coordinating Irrigation Water Use

Within the Study Area, there are four districts (Nyeri, Kirinyaga, Meru, Tharaka Nithi) where smallholder irrigated horticulture is presently considerable or has the potential to expand significantly in the near future. For each of the four districts, it is therefore planned to promote establishment of a "District Irrigation Sub-Committee" which will operate as a technical sub-committee of the already existing District Development Committee (DDC).

The irrigation sub-committee will be expected to meet twice a year and will have the following functions:

- Overview of irrigation activities within the district with special attention to key aspects of smallholder irrigation performance (water adequacy, water use efficiency, equity in granting of abstraction permits, compliance with MOALD irrigation guidelines, production and marketing constraints)

- Review of existing water resources in relation to granted water rights and planned irrigation activities (promoted by government or NGOs)
- Submitting recommendations to the DDC on aspects requiring coordination or other courses of action in order to improve overall performance of irrigation within the district (pooling resources, marketing constraints, water use efficiency, crop yields, farm incomes)

The DDC is the overall planning and co-ordinating organ in the district and any recommendations submitted to and endorsed by the DDC are likely to be acted upon by relevant Ministries, River Basin Catchment Boards, the Water Apportionment Board as well NGOs and Private Sector firms. The Water Apportionment Board is under the Ministry of Land Reclamation Regional and Water Development and is legally mandated to issue or cancel water abstraction permits. Normally, the Board issues a permit after considering technical recommendations (based on existing water rights and availability of water) from the district and catchment board levels.

It is anticipated that participation in the irrigation sub-committee will comprise:

- District Water Engineer (Chairman)
- District Irrigation Engineer (Secretary)
- District Social Services Officer (Member)
- District Horticultural Officer (Member)
- District Marketing Officer (Member)
- HCDA Representative (Member)

To enable setting up of a the above sub-committee, it is anticipated that IDB will prepare background papers on each district's irrigation status and the rationale for a district sub-committee on irrigation. The district paper will then be the subject of a one day workshop to be attended by representatives from relevant government ministries, farming community, local NGOs and the private sector. It is anticipated that the District Commissioner will open the workshop.

12.4.2 Proposed Agricultural Credit Systems

1) Plan for Strengthening of SISDO

With a view to consolidating its experience in managing smallholder irrigation credit programs, it is planned to assist and encourage SISDO to make an immediate and drastic review of its operation procedures as well as its overall management environment.

Such a review is expected to lead to the following desirable situation:

- Reduced overhead costs both at head office and at the regional centers
- Establishment of an efficient monitoring system for credit disbursement and repayment status including production of quarterly accounts
- Integration of a monitoring system with routine management tasks which could perhaps imply doing away with a separate monitoring section altogether
- Limiting the operational budget to income arising from lending activities (i.e. interprets and commission charges) and not from "loan capital funds"
- Establishment of a performance-linked remuneration structure both for the field and the Head Office thus improving the currently low staff morale

In order to speed up the necessary internal re-organization of SISDO, the Ministry of Agriculture and Livestock Development, as an important stakeholder and a co-signatory to a Memorandum of Understanding with SISDO, will be expected to formally communicate with the SISDO board about the current inadequate status of the organization. It is expected that achievement of the above changes will lay the foundation for a more sustainable lending institution to the irrigation sub-sector.

2) Cooperative Bank of Kenya (KCB)

The Cooperative Bank presently collaborates with SISDO in channeling irrigation credit to smallholder farmers. Farmers, however, perceive the bank interest rates to be too high while it takes too long to process loan disbursements (six months to one year from application to disbursement). It is therefore proposed that both SISDO and MOALD initiate discussions with the Cooperative bank with the aim of streamlining the decision-making process on smallholder loans as well as exploring the possibility of lowering the interest rate from the current 30 percent per annum.

3) Local Agricultural Input Stockist

Small-scale agricultural input stockists operate near, or live among rural communities. They occasionally provide input credit to individual farmers on trust based on intimate knowledge of the borrowers. These stockists are, therefore, indirect stake-holders in the planned irrigated horticultural production project since it is likely to stimulate demand for their products. At the same time, such stockists provide an opportunity for a locally-based credit system for supporting smallholder irrigated horticultural producers if proper conditions and arrangements are put in place.

With a view to incorporating the input stockists into the planned irrigated horticultural project, MOALD and MOCSS will be expected to encourage them to participate during community preparation sessions. Since local input stockists will be listed as one of the community's resources, they will then outline how they will contribute to credit availability for farm inputs and how the community itself can create the right conditions for this contribution.

Possibly, increased credit activities by local input stockists are likely to be based on the following conditions:

- Self-organization of farmers into small groups (10-20 members) for promoting saving habits among members (women's groups are already doing this within the Study Area),
- Each group approaching a stockist with the aim of negotiating an in-put credit on the basis of a 10 percent cash payment and the rest to be paid immediately current crop sale proceeds are realized (maximum three months),
- Members of the group to be individually and severally liable to pay the input credit, and
- MOALD staff or local NGOs to assist in drafting an appropriate loan agreement between the farmers group and the local stockist.

It is recommended that support be given to these local input stockists by offering short localized training on credit management and record keeping with a view to expanding and strengthening their capacity to give input credit to the farming community.

4) Credit from Produce Buyers

There is already some limited credit being given by horticultural exporters who have a production contract with farmers. It is planned that this type of credit will be encouraged.

Together with expected streamlining of the marketing system, it is anticipated that MOALD, HCDA and Fresh Produce Exporters Association of Kenya (FPEAK) will prevail on the majority of horticultural exporters to contract their production requirements and support their contracted farmers with input credit.

For this type of credit to be sustained, both the farmers and the buyers must be educated on an appropriate code of conduct. In this connection, assistance should be provided in drafting a standard "producer/buyer" contract which among other things should include provision of farm inputs on credit to the farmer and should spell out mutual obligations of both farmer and buyer. Such a contract format will be prepared in close consultation with FPEAK and GOK agencies.

5) Agricultural Finance Corporation (AFC)

During field investigations, there was no evidence of AFC supporting community-based smallholder irrigation. However, as a government institution established to lend to the agricultural sector, AFC should nevertheless be encouraged to review its attitude toward smallholder farmer groups. In this regard, MOALD will be expected to initiate contacts with AFC with the aim of reaching a practical arrangement for AFC to offer credit services to smallholder farmer groups in possible collaboration with another organization such as SISDO.

The main attraction with AFC loans is that it provides relatively more favourable interest and re-payment terms.

6) Alternative Sources of Irrigation Credit

Unavailability of development and input credit is a major constraint facing development of smallholder irrigated horticultural development within the Project Area. The MOALD needs therefore to take a lead in stimulating activities to smallholder irrigated horticultural production by undertaking the following initiatives;

- Convening a meeting at district level, or existing and prospective credit suppliers to a workshop where credit constraints and procedures can be discussed and harmonized.
- Conducting training sessions for potential credit suppliers (input stockists; produce buyers, production/marketing groups, women group etc.).

12.5 Community Development and Farmers Organization Plan

12.5.1 Community Development Plan

Hence, introduction of irrigation to a socio-economy, predominantly based on rainfed agriculture, because irrigation is not just an exercise in engineering and agronomic design but also a significant community event with far-reaching social and cultural implications. At the household level, the nature and distribution of roles within and among households is likely to change while the community as a whole will need to adjust the way it deals with the outside world.

To enhance chances of sustained performance, it is planned to integrate smallholder irrigated horticultural activities into the existing community's socio-cultural conditions. The aim will be to promote ownership of the project by the community so that they can accept it as an important community asset to be managed, protected and maintained with the same amount of commitment as the local church or school. To achieve this objective, it is planned to conduct community preparation sessions using PRA methods. The main objective of the community preparation sessions will be to empower the community to accomplish the following:

- Enhancement of their self-awareness by encouraging them to chronicle their history including major events that have happened around them,
- Analysis of their prioritized needs at various levels (community, household, gender, youth, others),
- Appreciation of the community's resources (natural, institutional, cultural, community members etc.),
- Identification of the constraints they face in perusing their needs,
- Preparation of a work plan, aimed at addressing the constraints, for which they will primarily be responsible and which will clearly spell out expected costs (sacrifices) and benefits in relation to gender as well as other household members.
- Acquisition of capacity to organize similar annual performance evaluation sessions on their own with only minimum support from MOALD and MOCSS

It is planned to conduct community preparation sessions in each project site with participation being drawn from a cross-section of the local community i.e.: local leaders (formal and informal), farmers, business people, teachers etc. The sessions will be facilitated by staff from MOALD and MOCSS with support from outside consultants. The expected outcome of a preparation session is a community that is willing to actively participate in planning, implementation and cost sharing of the planned irrigation and other technical innovations.

12.5.2 Farmers' Organizations Development Plan

1) Water Users Association Plan

In a community-based irrigation scheme, the main irrigation works (intake, supply canal/ pipe and secondary distributaries) are jointly shared by all the members. For the irrigation scheme to be developed, the following mechanism must therefore be established for:

- Planning and installing the common irrigation infrastructure

- Distributing and allocating irrigation water equitably
- Maintaining the common irrigation infrastructure on a regular basis
- Managing relations with the external world on matters relating to irrigation water (providers of support services, credit givers).

Field investigations within the Study Area, indicate that the single purpose "Water Users' Association" (WUA), is the most common form of "farmers organizations" for carrying out the above functions. Possible reasons for the preference of WUA are: the process involved in its establishment and registration is fairly simple and its management structure as well as associated operational routines are within the current capability of rural communities.

It is therefore planned to promote the establishment of new Water Users' Associations as well as to strengthen existing ones. This institutional capacity-building will be accomplished through a structured training programme that will include the following aspects:

- Implications of lack of community organization in relation to advantages and sacrifices associated with effective community organization
- Irrigation by-laws and conditions for their effective application
- Available alternatives for organization and management structures
- Leadership roles, leadership qualities and management skills
- Budget making and financial management
- Credit, funding sources and request procedures
- Development planning of irrigation main works (new or rehabilitation)
- Operation and maintenance as well as improved water management techniques
- Training visits to WUAs demonstrating good management and scheme performance

For each site where a WUA will be promoted or strengthened, it is anticipated that a total of 15 contact days will be required to cover all the training modules. The training period should, however, be spread over a period of six months in order to minimize disruption of the community's normal activities and also to allow time for one training module to have some practical impact before starting the next one. For instance, the first module will be targeted on all the prospective members of the WUA. However, subsequent modules will be aimed at committee members elected after the first training session. Training resource persons will be drawn from the MOALD as well as from the ranks of locational community development assistants employed by the county council. It is expected that these trainers will have already undergone a "Training of Trainers Course" which will have been given earlier by IDB and MOCSS staff with support from outside consultants or NGOs.

The expected outcome of the training program is a WUA that can reasonably procure credit for irrigation infrastructure, actively be involved in irrigation implementation, efficiently and equitably manage irrigation water and plan as well as execute a repair and maintenance routine.

2) Farmer Production and Saving Groups

Field investigations indicated that smallholder farm incomes are constrained by low produce prices and poor crop yields. To address these two closely related problems, it is proposed to promote farmer groups (10-20 members) who will seek to have a common approach to agricultural production. Ideally the members should come from neighboring farms so as to ease communication between

members. The MOALD front-line extension staff will facilitate formation of farmer production and savings groups.

The main objectives of these groups will be the following:

- Identifying a prospective buyer for their horticultural produce with whom they can negotiate a buying/production contract
- Starting a saving scheme by opening a group bank account where each member will contribute an agreed monthly amount
- Using some of the group savings to negotiate credit purchase of farm inputs at the local stockist shop or cheaper bulk purchase (for all group members) from the nearest urban center
- Maintaining records on market trends including prices, quantity levels, and market destinations
- Erecting a collection and grading shed for the groups' produce
- Providing a contact forum in which front-line extension assistants can provide group-specific extension support in respect of input requirements, application levels and methods as well as market information

Since group formations, particularly women's groups, are already common within the project area, it is anticipated that farmers' groups should be promoted fairly and quickly. What will take long, however, is to encourage the groups to become focused on tackling the two critical problems of low or unstable produce prices and savings for farm inputs. It is therefore planned to strengthen the groups through training in record-keeping, business accounts as well as negotiation skills.

Each group will require three consecutive days of initial training followed by another two days of follow-up.

After the training, each group should be able to maintain saving habits, negotiate production/buying contracts, plan their production to match expected market opportunities and explore alternative sources of input credit.

3) Farmer's Marketing Groups

The problem of marketing manifests itself mainly in terms of low prices at the farm level. The three underlying causes are: inadequate farmers bargaining skills, wrong timing of production in relation to market requirements, and poor access roads. To address the marketing problem, it is planned to promote the formation of marketing groups and facilitate their training on such aspects as;

- Benefits of group formation and group loyalty (short-term/long-term views)
- Alternative sources of market information (prices, destinations, volumes, market specifications)
- Information on competition from other producing areas (within/outside the country)
- Simple methods of carrying out a market survey
- Record keeping and interpretation of price trends
- Relationship between price trends and production scheduling
- Negotiation skills with middlemen, buyers and exporters

In organizing and supporting marketing groups, the main aim will be to enhance the farmers' capacity in dealing with buyers. Presently farmers feel helpless in their relations with buyers and as one farmer put it, "We only take the price the buyers give us". Depending on the situation, a marketing group can be the same as a production group but not necessarily so. The advantages of being the same group is that production can be coordinated with available marketing opportunities.

It is anticipated that each marketing group will receive a total of five training sessions consisting of three days consecutive training followed by another two days of follow-up.

The expected outcome of the training and follow-up support is a marketing group that has the capacity to negotiate with buyers as an equal partner and thus increase the prospect of high as well as stable farm-gate horticultural prices.

4) Farmers' Cooperatives

Coffee and dairy farmers' cooperatives are common in the high altitude areas of the Study Area where they carry out primary processing and marketing of these products. In addition they operate input stores as well as savings and credit accounts for their members.

However, Kenya's farmers' cooperatives have had a history of close government supervision where GOK cooperative officers had the final say on how the cooperative is managed, including powers to suspend a cooperative committee. The recent liberalization in the sector has led to reduction of government influence in the management of cooperatives. This has produced considerable disorientation in the cooperative sector as well as increased incidence of conflicts within individual cooperatives.

The climate is therefore not appropriate for promoting new cooperatives for horticultural marketing at this time. In addition, the management requirements for dealing with high turn-over perishable commodities, such as horticulture, are likely to be beyond the present capability of smallholder farmers.

In future, however, it may be anticipated that neighboring "Farmers' Production and Saving Groups" will gain sufficient skills and confidence to come together and form cooperatives for marketing their produce, mobilizing members savings and procuring farm inputs. Once this stage is reached, provision of support to such horticultural marketing cooperatives should be considered.

12.6 Irrigation and Drainage Plan

12.6.1 Water Source Plan

As a water sources for SIS in the Study Area, river water and groundwater are used. Nevertheless, the use of groundwater for irrigation can only be observed at a few schemes in Nyeri, Meru and Nyambene districts, because of low availability of groundwater. The irrigable area by

district which is estimated by the analysis of available river water is shown below table, and the future development of SIS shall be promoted within the available water resources.

	Nyeri	Kirinyaga	Embu	Mbeere	Tharaka Nithi	Meru	Nyambene	Total
Irrigable Area (ha)	2,601	1,468	836	1,792	1,113	3,069	342	11,221

The water use of river water is general in most of SIS. The method of water intake from rivers in SIS managed by farmers is by use of temporary masonry weir and concrete weir, and the method of water intake by reservoirs and pumping station is not introduced.

Since the operation of SIS will be executed by farmers' capital and technology, it is required that water source facility, which can be constructed by low initial cost and be operated easily, shall be adopted. Therefore, concrete weir is adopted as a type of water source facility in SIS development plan.

12.6.2 Canal Plan

1) Irrigation Canal

Since the Study Area is in the slope foothills of mountainous land, diverted water at a water intake site can be conveyed to irrigation areas through gravity-type canal system with a relatively short canal length. Therefore, gravity-type canal system is popular in the existing canal system, and the same type system is adopted in SIS development because of its economical advantage.

As a canal type, open channel and pipeline can be adaptable in the Study Area. From an economical view point, open channel type is favorable, and pipeline type has an advantage in water saving. On the adoption of pipeline type, it is essential to make enough evaluation to the project benefits arising from the project implementation because this type requires high initial cost and O&M costs.

2) Drainage Canal

Since the Study Area is sloppy, natural drains have been developed. Therefore, drainage canals are not required because the excess water caused by rainfall is drained by natural drains. However, as some areas located in the lower foothills of Mt. Kenya, have flat farm land where are suffered from poor drainage, collector drains shall be provided to such areas.

12.7 Road Development Plan

12.7.1 Basic Concept for Road Development

Since the Roads 2000 program has covered seven districts with assistance of SIDA for Nyeri and Kirinyaga districts and EC for Embu, Mbeere, Tharaka Nithi, Meru and Nyambene districts, most

classified roads including Minor Roads (E) and Rural Access Roads (RAR) are expected to be in maintainable condition by the year 2000.

Therefore, the road network, both primary and rural networks up to linkage between major villages will become passable with gravel surface at most road sections. In consideration of its foregoing Roads 2000 program, the road development plan under this Project will be formulated based on the following basic concept:

- i) National policy stated in the Eighth National Development Plan (1997 to 2001) will be followed, i.e. priority is given to the maintenance and rehabilitation of the existing roads.
- ii) Existing projects/programs for rehabilitation and O&M of roads will be taken into consideration, particularly the Roads 2000 program through which all classified roads will be made in maintainable condition.
- iii) Objectives of road development are to provide accessible roads from primary or rural networks to irrigated agricultural areas under the Project.
- iv) The road plan under the Project will basically be the improvement, rehabilitation and reconstruction of the access roads between irrigation schemes or agricultural areas and the nearest passable all-weather network roads. These roads are also to be considered as a farm-to-market roads.
- v) Farm roads will also be provided in farming areas wherever considered necessary to support the transport of farming materials and agricultural products.

Under the above concept, the following specific considerations shall be taken into account:

- Road standards to be improved, rehabilitated and reconstructed will be all-weather roads with at least a gravel surface so as to be accessible even in the rainy seasons.
- The road development plan will be established in conjunction with the irrigated horticultural agriculture development, since the road plan will focus the access roads towards each irrigation scheme. Identification of the roads to be improved/reconstructed will be made based on the District Profile Up-date Survey conducted by the JICA Study Team.
- The labor-based method (LBM) will form the basis of the implementation since it has been an important role of the road projects in Kenya and benefited the rural communities.
- Since roads are considered as a public infrastructure, the O&M shall be undertaken by the government. However, the end part of the access roads which are mostly concerned with only one or two villages can be maintained by the local communities if said roads are considered to belong to such communities/villages. Therefore, community involvement in O&M activities as a means of community contracting will also be considered.
- Road gradient and structure are important factors to be considered in the plan to build sustainable roads of low cost and easy maintenance as the topography of most areas around Mt. Kenya is mountainous and undulating terrain.

- Physical planning of the road development will be based on the MRP Technical Manual of MPWH.

12.7.2 Access Roads and Village/Farm Roads Plan

1) Access Roads

Based on current conditions of the access roads to the irrigation schemes, work categories of the access roads improvement plan are divided into three types, i.e. regravelling, rehabilitation and reconstruction.

Regravelling work is applied to the road section where light improvement mainly with spot gravelling is required. Rehabilitation work means that the road needs regravelling with rather hard grading and spot improvement. Reconstruction work is applied to the road section where the improvement at reconstruction level is required.

Three types of road cross section are considered in the access road improvement plan as shown in Annex P.

2) Village/Farm Roads

Village/farm roads are basic agricultural infrastructure contributing to the development of the irrigated horticulture schemes. However, since the construction of new roads requires land acquisition from smallholder beneficiary farmers, improvement plan shall be mainly for existing roads as regravelling, rehabilitation and reconstruction. Plan for new construction shall be the minimal level. Cross section of the village/farm road is presented in Annex P.

12.8 Rural Water Supply Development Plan

12.8.1 Basic Concept for Rural Water Supply Plan

Water supply for domestic use is the most essential human need. Taking into consideration of the necessity of the upgrading present living condition in the rural communities to secure sustainable agriculture, rural water supply development will be formulated based on the following concept:

- i) Under the community-based irrigated horticulture development project, rural water supply will be planned in the areas where water supply facilities for domestic use do not exist.
- ii) Rural water supply projects shall be on self-help basis. Implementation of the rural water supply plan will be on the community initiative basis with full support from the government agencies on technical and institutional matters.
- iii) Identification and development of safe water for domestic use.

12.8.2 Rural Water Supply Development Plan

The number of rural water supply facilities to be planned in the Project will be estimated from the present coverage ratio from existing rural water supply facilities. Rural water supply development plan amounts to 166 projects in seven districts.

12.9 Environmental Conservation Plan

12.9.1 Initial Environmental Examination (IEE)

IEE was carried out based on JICA Environmental Guideline. In case that water allocation considering downstream area, extension service and training of community leaders and farmers, etc. are executed properly, any serious negative impact will not be expected (Details are shown in Table T.1.18 and 19, Annex T). However some minor negative impacts will be expected as follows;

- Increased use of agro-chemicals by the promotion of horticulture and intensive agriculture by irrigation.
- Deterioration of river water quality by the increased use of chemical fertilizer and agro-chemicals.
- Increase of water related diseases (malaria, amoebiasis, etc.) by the increased source of diseases by furrows.
- Damage of crops by wildlife in irrigated farmlands in the dry season.

And the success of the Project will bring a lot of positive impact for social and natural environment as follows;

- Increased crop production by irrigation farming will bring the income increase and it will make easy to raise the education and medical fee.
- Intensive agriculture by irrigation will be able to cope with the fractionization of farmland by the increase in population.
- Community will be active by the strengthening of farmers' organizations.
- Prevention of soil erosion will be strengthened, soil fertility will be improved and a cause of water deterioration of rivers will be taken away by the active farmers for soil and water conservation.
- Water environment will be protected by the appropriate water allocation considering with the downstream area.

12.9.2 Environmental Impact Assessment (EIA)

The process towards developing the environmental law is at an advanced stage. The draft documents of EIA guidelines and environmental standards have been approved at the technical level and will be approved by the Parliament within 1998. After the approval of environmental law, EIA shall be executed at the stage of master plan or feasibility study in all projects including agricultural development, and the permission for the project implementation by the National Environment Secretariat is required. Therefore, EIA was carried out at the feasibility study stage, based on JICA Environmental Guideline as provisional measures. MOALD shall apply the permission of the

project implementation based on the result of this EIA.

EIA was carried out in the four Project Areas, attached more importance to the study of the following items and environmental impact by the project implementation was estimated.

- Present condition of health and sanitation (medical facilities, diseases, drinking water, etc.).
- Present condition of agro-chemical use.
- Present condition of soil and water conservation and the awareness of farmers.
- Present condition of crop damages by wildlife.

According to the EIA survey, there will be some negative impacts due to the project implementation including deterioration of water quality, increase of water-related diseases, etc. However, these impacts would be minor considering the small-size of the scheme. Environmental consideration is required even for the small-scale project and the Project should include soil conservation plan and water source management plan, which have a direct influence upon agriculture, as same as public health plan and anti-malaria plan, which have an indirect relation with agriculture.

12.9.3 Soil Conservation Plan

Soil conservation is the most important issue for the sustainable agriculture and for the increase of agricultural products. It is executed by the Soil and Water Conservation Branch of MOALD and their main activity is training of farmers to encourage the improvement of soil fertility and prevention of soil erosion. Therefore, it is effective to keep in contact with their plan and it should include the technical support for the following items;

- Plantation of trees along farm plots and rivers for the feed, firewood, improvement of soil fertility and prevention of soil erosion. Introduction of useful trees not only Grevillea and the technical support for the nursery shall be carried out.
- Plantation of grass as terrace banks at the coffee production area.
- Sanitary management of livestock and production of manure.
- Thoroughness of crop rotation for horticulture and input of manure for the prevention of outbreak of diseases and insects on crops that is related with the decrease in agro-chemical use and decrease of influence in soil.
- Decrease of firewood consumption by the promotion of improved cooking stove that has a higher thermal efficiency. It has been already promoted in some areas such as Nkunjumo in Meru.

12.9.4 Watershed Management Plan

The management of Mt. Kenya Forest Reserve that is the water source of many rivers is necessary for the stable supply of water for drinking and irrigation. The watershed management plan shall be executed by Forest Department, Kenya Wildlife Service (KWS) and MLRRWD as Mt. Kenya Forest Reserve is mainly controlled by Forest Department, Main activities shall be the identification of catchment area to be rehabilitated, river bank protection, strengthening of control against illegal logging, etc.

12.9.5 Public Health Plan

In case that the agro-chemicals are used inadequately and high toxic agro-chemicals are used, it will affect farmers' health and water pollution of rivers that are used directly as drinking water generally. A cause of coliform contamination of rivers and springs may be livestock that comes to these places to drink water. Therefore, the public health training for farmers should be promoted to inform the risk of agro-chemicals and to promote the protection of rivers from livestock and agro-chemicals. Public health plan shall form a part of extension service by MOALD and include the following items:

- Knowledge about the risk of agro-chemicals for river that is used as drinking water.
- Establishment of drinking place for livestock so that they do not enter the river.
- Plantation of trees around the river and farmland since the forest is useful for the purification of soil water.
- Sanitary education including the use of boiled water for drinking (Frequent warning at primary school is required).

Further, the water quality of rivers, springs and wells shall be analyzed periodically by MOH and the result shall be informed to the inhabitants.

12.9.6 Anti-malaria Plan

The top of diseases reported in the foothills of Mt. Kenya is malaria, though the medical facilities are not sufficient and any concrete measures are not established. It is important to complete the medical facilities, but the simple preventive measures for farmers may be growing of medical plants. Actually, a farmer is growing the plant "Queen of the Night" that is expected to prevent the malaria mosquito at Rupingazi in Embu. A kind of medical plants is decocted as medicine against malaria at Ruungu in Tharaka Nithi. Lemon grass that is growing at a part of foothills of Mt. Kenya as herb tea for export is known as anti-malaria mosquito plant. MOALD and MLRRWD are required to study these plants scientifically and to support farmers for the growing of effective medical plants against malaria mosquito.

12.10 Operation and Maintenance Plan

12.10.1 Operation and Maintenance Agencies and Organization

Executing agencies/bodies for the operation and maintenance (O&M) of facilities and equipment built/purchased under the Project are divided into two categories, i.e. public sector and private sector (refer to Annex R).

- Public Sector

- | | |
|-------------------------|--|
| 1) Marketing facilities | : District County Council |
| | : Municipal/Town Council |
| | : Horticulture Crops Development Authority |
| | : (HCDA) |
| 2) Access roads | : District Works Office (MPWH) |
| | : District County Council |

- Private Sector

- 1) Irrigation/drainage facilities : WUA
- 2) Village/Farm roads : Village Community
- 3) Access roads : Village Community
- 4) Rural water supply facilities : Project committee (PC)
- 5) Post-harvest facilities : Farmer's marketing groups

12.10.2 Operation and Maintenance Plan

1) Irrigation and Drainage Facilities

O&M of irrigation and drainage facilities will be executed by a WUA which is formed by beneficiary farmers. The establishment of a WUA will be supported by MOALD with assistance from NGOs through the implementation of community development and support services. During the O&M stage, technical support shall be extended by the District Irrigation Units of MOALD.

Major O&M activities are water distribution management, cleaning and repair of canals/pipelines, repair of structures, and so on. Membership fees shall be collected by WUAs from the beneficiary member farmers, and they are used for O&M activities.

2) Village/Farm Roads

O&M activities of village/farm roads shall be executed by village community. Major activities of O&M is routine and periodic maintenance which includes the sweeping of roads and side ditches, spot gravelling, repair of road structures, etc.

The lengthman method can be introduced for the actual maintenance operations. Every beneficiary farmer is to be assigned to a certain road section for the maintenance of farm roads to be carried out by him. Arrangement of the distribution of roads to farmers is to be made by village community.

3) Access Roads

Access roads between the existing all-weather network and the irrigation schemes can function as farm-to-market roads as well as village access roads. Therefore, rural communities shall contribute to maintenance of access roads under the assistance of the government agencies which are to be the main O&M body since roads are considered as public infrastructure. The O&M for part of access roads which is considered as village access roads shall be planned to be handed over to the village community under community contracting.

A community contract is an agreement between a community-based organization (CBO) and an external support agency like MPWH or county council or donor agency to carry out a maintenance activity of access roads for the benefit of the community. This is valuable in organizing minor works under LBM such as routine maintenance which have a direct impact on the living environment of low income communities. Community contracts also reduce O&M costs and create local employment, develop social capacities of communities and lessen dependence of communities on

government services.

In order to introduce a community contract on the maintenance of village access roads, community's awareness of road ownership shall be developed and support system by government agencies be established. From the planning/design stages of the road improvement and rehabilitation projects, participation of village communities shall be considered.

Road sections other than village access roads undertaken by a village community shall be maintained by either the District Works Office of MPWH or District County Council according to the road classification.

4) Marketing and Post-Harvest Facilities

Major market facilities such as cold storage and wholesale/retail market shall be operated and maintained by either HCDA or local governments such as district county council and municipal/town councils. Farm Management Division of MOALD shall execute the support services, such as markets, such as market information and so on through the marketing support services program.

On the other hand, O&M of the post-harvest and processing facilities at farm level shall be undertaken by farmers' marketing groups which have been newly organized or strengthened by MOALD, HCDA and NGOs.

5) Rural Water Supply Facilities

Since the rural water supply facilities are planned within the category of self-help and community-initiated project, O&M shall be executed by a Project Committee (PC) which is composed by beneficiaries. The establishment of a PC shall be supported by the District Water Office of MLRRWD, and technical services be extended during the O&M stage.

Major O&M activities of the PC are repair of pipelines and structures and efficient management of the system. Membership fees shall be introduced for O&M of the water supply system to be sustained.

12.11 Project Implementation Plan

12.11.1 Project Implementation Methods and Agencies

The lead implementing agency shall be the MOALD and supporting agencies the national line agencies, local governments, NGOs, JKUAT, financial agencies, private sector, etc. An Executive Steering Committee (ESC) shall be established with chairmanship of a MOALD Permanent Secretary. A Technical Working Committee (TWC) shall also be established under ESC for smooth Project implementation. Both ESC and TWC shall be located in Nairobi, and District Project Management Office (DPMO) be established for actual project implementation at the field level. Proposed organization chart for project implementation is presented in Annex R.

Implementation mode for facility construction shall be on a contract basis, therefore general contractors are selected through tendering. On the other hand, the community development and support services shall be implemented by the related government agencies mainly through consultants and NGOs which are hired on a contract basis.

Community initiatives shall be closely evaluated during the implementation of each project, thus community development programs under the Project shall be commenced prior to the implementation of sectoral construction projects. At the same time, responsibility for O&M of facilities to be provided under the Project shall be well arranged and agreed on by both main O&M bodies and support agencies.

12.11.2 Agricultural Supporting Organization

Since the Ministry of Agricultural and Livestock Development (MOALD) has the mandate for national agricultural performance, it will bear the responsibility for coordinating all the support services to smallholder farmers. The Ministry's capacity to play this coordinating role has recently been enhanced by the newly established "Agricultural Support Investment Program" (ASIP). For example, it is expected that once ASIP is operational, MOALD will be able to issue "Authority to Incur Expenditure" (AIE) to the Ministry of Public Works and Housing to repair or maintain an access road that is constraining agricultural production in a given area.

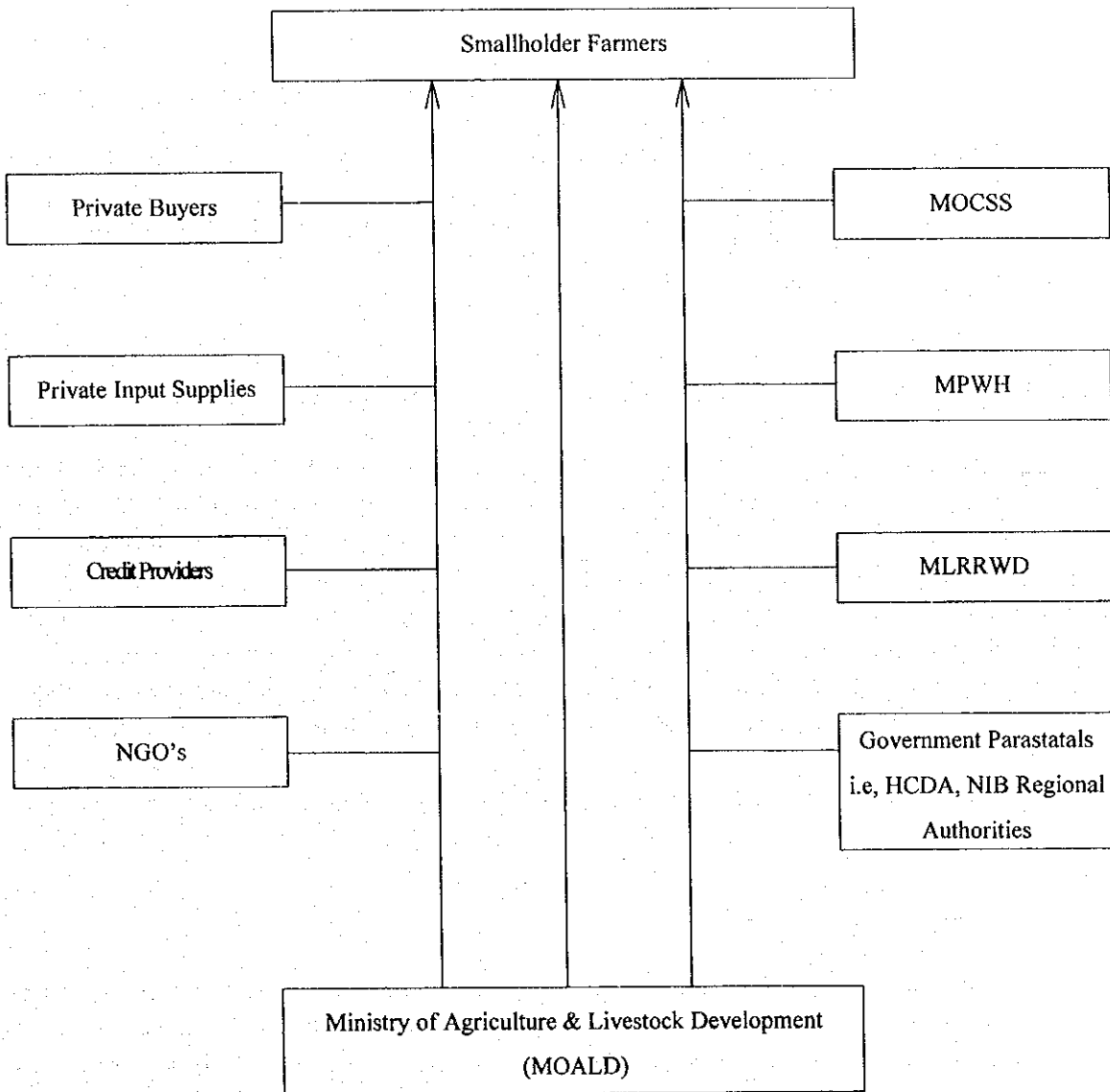
Hence, while MOALD will provide the bulk of support services to the farming community, it is also expected to develop coordinating links with two other categories of service providers.

- Public Sector Agencies
 - Ministry of Culture and Social Services (community preparation support)
 - Ministry of Public Works and Housing (access roads support)
 - Ministry of Land Reclamation, Regional & Water Development (water availability)
 - Government Parastatal Agencies and County Councils (marketing, extension support)

- Private Sector Agencies
 - Private Buyers (improved marketing services)
 - Private Input suppliers (affordable input services)
 - Credit Providers (efficient credit services)
 - NGOs (credit & extension services)

The organization arrangement for support services is depicted in Figure 12.11-1.

Figure 12.11-1 Organization of Institutional Support



12.11.3 Implementation Schedule

1) Implementation Schedule for Model Areas

In formulating the implementation schedule for the selected Model Areas, the followings should be taken into consideration;

- Implementation capability of Irrigation and Drainage Branch (IDB) in MOALD, specially focusing on allocated budgets and staff capability,
- Implementation capability of NGOs, which are main supporting organization for the Implementation of the smallholder irrigation schemes,
- Scale and items of construction works for agricultural and rural infrastructural facilities
- Farmer's capability for project implementation, and
- Improvement of credit conditions for farmers to implement the smallholder irrigation schemes

Implementation Capability of Irrigation and Drainage Branch (IDB) in MOALD

Development budgets allocated to IDB in fiscal year of 1997/98 decreased in 1,220.5 thousand Kenyan Pound in accordance with getting worse of Kenyan economy, and this decreased amounts in 1997/98 are equivalent to 30 percent of 1994/95 budgets. The major reasons of budget reduction are derived from the discontinuity of fund aided from foreign donors, especially from the year of 1995/96. Under the situation, it is reported that annual progress of irrigation and drainage project under IDB is in the range of 60-70 ha only in the whole country. Furthermore, total numbers of technical government staff in IDB stationed in Central office, Provincial and District Irrigation Units are 175, and these numbers are deemed to be too low with about three staffs per district.

Under the situation, it could not be expected that IDB budgets would be sharply increased in an early stage.

Implementation Capability of NGOs

Main supporting organization for implementing smallholder irrigation schemes is NGOs, and one of NGOs doing activities related with the schemes is SISDO. SISDO has been undertaking the development and improving the economic status of smallholder farmers through, i) delivery of credit services, ii) farm inputs for horticultural farming, iii) supervision for construction of irrigation and drainage facilities, iv) zero grazing (dairy cows), etc. However, surplus of income over expenditures has been increased rapidly from the year of 1996/97, resulting in current SISDO's tight financial conditions. Furthermore, total number of the organization staff with only 29 makes difficult to manage effective supporting activities in the works.

Under the situation, it will be considered that strengthening of implementation body of NGOs inclusive of SISDO, will be needed in the aspects of technical and financial subjects for effective implementation of the smallholder irrigation schemes.

Scale and Items of Construction Works for Agricultural and Rural Infrastructural Facilities

Proposed agricultural and rural infrastructural facilities should be planned in an adequate scale and quantity of construction works, taking due considerations of characteristic of smallholder irrigation schemes, that is, full cost recovery of project facilities by farmers, farmer's undertaking of operation and maintenance work for project facilities, sustainability of project, etc. Therefore, type of project facilities should be simple and traditionally applicable structures to the area. Under the situation, construction periods for each scheme is in the range of one to one and half year.

Farmer's Capability for Project Implementation

Participation of farmers to the project implementation is a principle, prerequisite and essentials in the project. In order to cope with these requirement, it would be important to raise the farmer's capability in the aspects of social preparation for community development, fund procurement for self-help projects and follow-up support services for sustainability. Especially, social preparation works to farmers in the community should be effectively undertaken prior to the project implementation.

Improvement of Credit Conditions for Farmers

Current credit conditions for implementing smallholder irrigation schemes are severe to farmers, due to high interest and short periods of repayment conditions. Therefore, proposed credit conditions to farmers should be discussed with the related agencies such as MOALD, NGOs, credit banks of CBK and DBK, farmer's representative, and appropriate credit conditions should be agreed among such related agencies to get their consensus. The proposed credit conditions mentioned above would be studied in the feasibility study for the selected Model Areas.

After due consideration of above mentioned matters, it could be assumed that a total implementation period would be seven years consisting of one and half year for social preparation, one and half year for construction of project facilities, and four years for demonstration of Model Area, follow-up support service, etc.

2) Implementation Schedule for Smallholder Irrigation Schemes in Seven Districts

a) Classification of Smallholder Irrigation Schemes and Implementation

The selected four Model Areas mentioned in the above have different characteristics and situations. And, their functions are; i) pilot farm for the development of smallholder irrigation schemes in seven districts, ii) monitoring of actual implementation process, especially emphasizing on effects and efficiency obtained through improved horticultural farming under irrigation conditions, and iii) application of obtained effects and experience to other smallholder irrigation schemes facing the similar problems and constraints at present.

Therefore, about 460 of existing smallholder irrigation schemes located in the seven districts around Mt. Kenya were classified into five types (Type-A, B, C, D, E), in accordance with the

classification of the Model Areas. Following table indicates the classified scheme numbers of model types by each district (details are referred to Feasibility Study).

Analyzed Scheme Numbers of Model Types

District	Types										Total
	Existing Schemes		Expansion and New Development Scheme								
	Type -A	Type -B	Type -C(1)	Type -C(2)	Type -D(1)	Type -D(2)	Type -D(3)	Type -E(1)	Type -E(2)	Type -X	
Nyeri	6	1	6	19	7	12	6	12		1	70
Kirinyaga		2	8	10	3	5		5			33
Embu		2	6	20	9	6		5	1		49
Mbeere			6	2	6	1	1	12		1	29
Tharaka Nithi	1	1	5	4	8	3			26		48
Meru	5	6	29	22	33	33	9	54		5	196
Nyambene		1	5	2	5				25		38
Total	12	13	65	79	71	60	16	88	52	7	463

Note; Schemes classified into Type-X indicate the area being not available to be classified, because of insufficient data in the District Profile Survey.

b) Implementation Schedule

Since the current Kenyan economy is situated in severe economical and financial conditions as mentioned previously, it will be recommendable to formulated the implementation schedule from view point of short-term implementation schedule.

Under such considerations, implementation schedule for smallholder irrigation schemes in seven districts will be studied for the following two cases; Case-1: under the same situation of IDB budgets even in future, and Case-2: under the increased IDB budget as same level of budget in 1994/95. In the study, following assumptions are taken into considerations;

- Average project costs per area (average about 270 ha) is about 5,500 thousand Ksh, which is derived from the cost estimation in Model Areas. Beneficial farmers will repay this amount.
- 50 percent of the development budgets allocated to IDB could be used for this project.
- Necessary IDB expenditures for carrying out the project implementation are assumed to be the same amounts of project cost of the scheme.
- The project costs necessary for improvement of rural infrastructural facilities such as road improvement, marketing facilities improvement, etc. will be procured by the related government agencies.

In the Case-1, annual development areas will become two schemes with project area of about 540 ha, under the allocated IDB budget of 1,220 thousand Kenyan Pound. On the other hand, in the Case-2 annual development areas will be of seven schemes under the allocated IDB budget of about 4,030 thousand Kenyan Pound, on the basis of above mentioned assumption.

The commencement of project implementation for these schemes is planned at the stage of three years, which correspond to the completed year of social preparation works for rural community

(1.5 year) and construction work of project facilities (1.5 year), so as to expect the effective demonstration effects of the Model Area so far made.

The selection of schemes for implementation should be undertaken considering the equal distribution of scheme in the seven districts, development priority in the district, demonstration effects by the implementation in the vicinity of the scheme.

12.12 Improvement of Socio-Cultural Conditions

12.12.1 Institutional Aspects

After the Plan is successfully implemented, the main outcomes at the institutional level will be a better coordinated institutional effort aimed at supporting smallholder farmers. More specifically, the following results will be expected:

- MOALD staff will have increased their capacity to deliver improved extension services direct to project farmers and will gain the experience to make coordinating linkages with other agencies delivering complementary services from the public and private sectors
- Other operational Ministries and parastatal organizations as well as NGOs will have been sensitized on a common approach to delivery of support services
- The Ministry of Culture and Social Services will have an enhanced role in farmer preparation and farmer group formations
- Water User Associations will have acquired capacity to participate in irrigation development, manage water efficiently as well as maintain the principal irrigation works
- Farmer production & saving groups will be able to negotiate fair producer/buyer contracts with exporters and other buyers
- Farmer marketing groups will gain skills and confidence to negotiate a fair price for their produce

12.12.2 Social Aspects

Implementing only small scale irrigation to promote horticultural farming in the Study Area does not always mean that project benefits will be generated soon. And the Project must have sustainability. To attain sustainable irrigated agriculture, farmers are requested to have an awareness of farm management, not only for planting crops, which is weak at present. Despite potential for productive farming even under rainfed conditions, farmer's awareness of improved farming on their own initiative has so far been weak.

Therefore, the importance of strengthening agricultural extension services and training for farmers would increase to enlighten those farmers, which will be given to farmers as outer conditions. Farmers will notice the necessity for awareness of farm management and crop quality, production to

meet demand in markets, equitable water distribution, harmonized activities in the rural society, fostering leadership, method for credit use, etc. through those extension services and training, which are considered as the most important factors among the soft aspects of benefits and realize sustainable irrigated agriculture. This must be continued on a long term basis and regularly. The government is required to allocate adequate budget for agricultural extension and training to enlighten farmers.

Payment conditions of current agricultural credit system are considered difficult for smallholders in terms of accessibility and utilization. Taking into consideration that 98 percent of farmers in the Study Area are classified as smallholders who produce the most food and horticultural crops for the people, new credit service to which farmers could easily have access might be necessary or alleviation of current repayment conditions might be required. In this regard, results of financial analysis will give some direction to improve credit services for smallholders.

As to marketing, the private sector should continue to have initiative in the future too. However, as described before, the current bargaining and marketing system is advantageous for traders/exporters. Under the current situation, farmers are compelled to sell their produce even at lower prices than production cost invested. It is said that contract farming is also risky. To improve these status, the establishment of cooperative societies will be proposed to negotiate with traders on equal terms on a group basis collecting occasional marketing information on prices. DAO of each district should have the function of observing marketing activities, in particular for fairness of pricing of crops and of advising in order to request fair bargaining between farmers and middlemen, if necessary. In cases of contract farming, DAO should sign on the agreement as a witness and observe fairness of their activities.

While, on the farmers' side it is required to accept positively agricultural extension services, training, credit services etc. which will be given as outer supporting services. Particularly, operation and maintenance of the irrigation facilities, collection of water charges, setting up of water users' associations etc. are indispensable for sustainable utilization of the irrigation facilities. Without any understanding and cooperation by farmers, small-scale irrigation can not be realized and these important factors need community-based cooperation, not on an individual farmer basis. Farmers are also requested to recognize that they play the leading part in managing small scale irrigation on a community basis in order to develop region centering on agriculture.

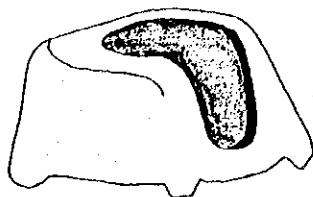
In addition to the implementation of hard aspects such as irrigation facilities and rural/market roads, supporting services on soft aspects as mentioned above are indispensable to manage irrigation facilities efficiently. Implementation of both hard and soft aspects in a balanced way will contribute to generating benefits and to construct better communities.

12.12.3 Environmental Aspects

Undulating farm lands and bushes/forest range widely across the Study Area. Coffee and tea are generally planted on farm lands with relatively steep slope and maize and banana on lands with gentle slope, and vegetables on the most gentle slopes or flat lands. On the sloping land, gully and soil erosion caused by rainfall are observed and napier grass is planted along the contour line both for preventing erosion and feeding animals. For the sustainable agriculture in the undulating lands,

conservation of farmlands by using fodder crops will be indispensable in the future too.

The most popular fuel used in the Study Area is fuelwood. Though some parts of the Study Area produce charcoal, afforestation should be promoted to conserve forest resources on a regional basis, while cooking stoves as shown below should be used in individual households, which is effective to raise energy efficiency of wood, resulting in reducing use of fuelwood. Therefore, it will be necessary that farmers understand the importance of forest conservation through training.



Since water resources for domestic use in the Study Area are contaminated, which was verified by the Study Team, agreement on conservation of water quality by preventing access for cattle to the water resources etc. will be necessary on a community basis. As irrigation facilities will be available for domestic water use, water users associations are required to take a leading part in conservation of water quality.

Utilization of chemical fertilizer and agricultural chemicals might cause damage to water quality of rivers and other water resources and humans themselves, directly. In addition, some problems on residual chemicals in exported crops have been reported in the destination countries. Therefore, it will be necessary to train farmers on how to use, number of times to be sprayed, timing and growing stage of crops to be sprayed, suitable concentration etc. through provision of materials and manuals in continuous extension services and training.

To attain environmental conservation, people's understanding and recognition and cooperation are certainly necessary and continuous and long-term educational training for farmers will also surely be necessary.

CHAPTER XIII.

SELECTION OF MODEL AREAS

CHAPTER XIII. SELECTION OF MODEL AREAS

13.1 Current Smallholder Irrigation Schemes

There exist currently 463 smallholder irrigation schemes (SISs) (total areas of 63,982 ha) in the Study Area. Out of these SISs, 250 (areas of 6,919 ha) are currently irrigated with irrigation facilities provided, and however the schemes fully irrigated with 100 percent of the proposed irrigation area are only 22 schemes (areas of 1,449 ha). The annual development of irrigation area over the last 20 years was about 350 ha on average with slow development progress. The reasons for such slow progress are considered that SISs development have the following constraints resulting from the defects and immaturity of the SISs supporting system, farmers organization and transportation system.

Poor Marketing System

- Lack of information on production elsewhere
- Weak bargaining power of farmers
- Lack of access to market
- High margin by middleman
- Seasonal gluts of production
- Failure of contract farming

Poor Production System

- Insufficient water for crops
- Poor farm management
- Defectives of strategy and tactics on irrigation development
- Low adaptability of farmers to meet selling standard
- Soil fertility deteriorating
- Sub-optimal farm size

13.2 Definition and Function of Model Areas

The above-mentioned constraints are commonly observed in all irrigation schemes in the Study Area. Under the situation, in order to analyze these problems and constraints to be solved, and also to expect demonstration effects as a model area in terms of smallholder irrigation scheme, the proposed Model Areas will be defined as shown below with the following functions;

- Monitoring of actual implementation process in the smallholder irrigation scheme development, especially emphasizing on effects and efficiency obtained through improved horticultural farming under irrigation condition,
- Application of obtained effects and experiences to other smallholder irrigation schemes facing similar problem and constraints at present, so that Model Areas will play an important "pilot area" in developing smallholder irrigation schemes.

13.3 Selection of Model Areas

13.3.1 Category of Existing Smallholder Irrigation Schemes

The existing 463 smallholder irrigation schemes of mentioned in the above could be categorized into following five types (Type-A, B, C, D, and E) taking into account the prevailing situation of these schemes such as implementation stage, operation conditions of the scheme, etc. The characteristics of each Type are presented below;

Implemented Schemes

Type-A : This type is the existing scheme with irrigation and farming activities well-managed and with provision of irrigation facilities and establishment of farmer's organization,

Type-B : This type is also an existing scheme, but with irrigation and farming activities not well-managed due to ineffective functions of irrigation facilities and weak farmers' organization ,

Proposed Schemes (Expansion and New Development Schemes)

Type-C : This type is a proposed scheme, and is categorized into favorable situations with easy accessibility to area by all-weather roads, low construction costs per hectare, and a high percentage of horticultural cropping, as indicated below with different ranges of factors ;

Type-D : This type is a proposed scheme, and is categorized into a moderate to severe area with relative hard accessibility to area, relative high construction costs per hectare, and fairly percentage of horticultural cropping.

Type-E : This type is also a proposed scheme situated in poverty conditions, especially in those districts of Nyambene and Tharaka Nithi.

	Accessibility to Area from All Weather Roads	Construction Costs per Hectare	Percentage of Horticulture Crop
	(km)	(Ksh/ha)	(%)
Type-C:	≤ 1.0	> 13,200	> 70
Type-D:	≥ 2.0	> 13,200	> 60
	≤ 6.0	< 266,700	< 69
Type-E:	≥ 7.0	> 13,200	no consideration

The classification of all smallholder irrigation schemes of 463 into five groups mentioned above will be discussed in the subsequent paragraph of "13.4 Classification of 463 Smallholder Irrigation Schemes by Model Area's Types".

13.3.2 Selection of Representative Candidates for Each Type of Model Areas

In accordance with above mentioned criteria, the analyses of representative candidates for four types of Model Areas except for Type-A were made applying auto-filter methods using computer, based on

the database analysis using the results of District Profile Survey conducted during the Phase-I field works. Results of the analysis are given in Table O.1-1 to Table O.1-5. As the results, following nine candidates for four types were selected as first screening.

The reason why Type-A is excluded from the Model Area is presently well-managed in both hardware of irrigation water supply and software of farmers' organization, marketing, etc., and major features of Type-A Model Area such as Muguma Water Project and Ciambaraga Irrigation Scheme are given in Annex O.

Representative Candidates for Model Areas by Types

District	Type-B	Type-C	Type-D	Type-E
Nyeri	Mathina (UM)			
Kirinyaga		Nyangati (LM)		
Embu	Rupingazi (UN)			
Mbeere		Karaba (LM)		
Tharaka Nithi				Irigu (UM) Ruungu (LM)
Meru			Kamiura (LH) Nkunjumo (UM)	
Nyambene				Itutha (LH)

Note; Alphabet in parenthesis indicates the symbol of Agro-Ecological Zone.

13.3.3 Selection of Representative Model Areas

In order to select one representative one Model Areas in each type, field surveys for nine schemes mentioned above were made to confirm the present situation in each site, of which survey results are summarized in Table 13.1-1.

Through these field survey and evaluation meeting with MOALD staffs, the following four areas were finally selected as representative Model Areas in each type of classification.

Selected Representative Model Area

Type	Irrigation Scheme	District
Type-B :	Rupingazi Ngerwe Irrigation Schemes (EMB-34)	Embu
Type-C :	Ngomano/Nyangati Water Furrow Project (KIR-22)	Kirinyaga
Type-D :	Nkunjumo Water Project (MER-10)	Meru
Type-E :	Ruungu/Karocho Irrigation Project (THA-40)	Tharaka Nithi

Note; Location of selected Model Areas is shown in Figure 13.1-1.

In this selection work, the following selection criteria are taken into consideration;

- Availability of water resources at the site
- Present situation of horticultural activities
- Administration
- Present situations of irrigation facility and farmers' organization

Table 13.1-1

Surveyed and Evaluation Results of Model Areas' Candidates

	Rupingazi Ngerwe Irrigation Scheme	Mathina /Ngogithi	Ngomano/Nyangati Water Furrow Project	Karaba	Nkunjumo Water Project	Kamitira Water Project	Rungu/Karochi Irrigation Project	Itutha Water Project	Irigu Water Furrow
a) Accessibility to Area from All Weather Roads(km)		0.0	0.0	0.0	3.0	3.0	25.0	22.0	10.0
b) Construction Cost per Hectare (Ks/ha)		10,815	9,065	9,065	109,200	266,700	21,700	39,690	134,190
c) Percentage of Horticultural Crop (%)		70	70	70	67	67	40	70	50
2. Selected Representative Model Area									
3. Area Information									
a) Serial Number	EMB-34	NYE-11	KIR-11	MBE-18	MER-10	MER-43	THA-40	NYA-22	THA-4
b) District	Embu	Nyeri	Kirinyaga	Mbeere	Meru	Meru	Tharaka Nithi	Nyamene	Tharaka Nithi
c) Division	Manyatta	Kieni East	Mwea	Mwea	Abo Central	Abo West	Tharaka Cent.	Tigania East	Chuka
d) Location	Nginda	Thigu	Nyangati	Karaba	Gatimbi	Katheri	Karochi	Ankania	Muiru
e) Latitude	00°26'14" S	00°21'06" S	00°34'61" S	00°31'62" S	00°01'67" S	00°01'97" N	00°06'87" S	00°10'49" N	00°50'61" S
f) Longitude	37°27'30" E	37°01'19" E	37°21'19" E	37°21'18" E	37°39'41" E	37°33'84" E	37°51'12" E	37°52'70" E	37°22'66" E
g) Area (ha)	40.0	84.0	400.0	100.0	100.0	200.0	1,000.0	150.0	250.0
Total Area	1.0	36.0	13.0	5.0	16.0	3.5	0.0	6.0	10.0
Present Irrigated Area	36.0	63.0	72.0	50.0	60.0	80.0	68.8	16.0	40.0
Present Farm Household	150	210	66	40	80	36	170	74	70
i) Distance from Scheme to Major Market (km)	8.0	5.0	10.0	10.0	7.0	8.0	37.0	39.0	10.0
j) Road Conditions	Medium	Medium	Good	Medium	Medium	Medium	Poor	Poor	Medium
k) Agro-Ecological Zone	UN	UM	LM	LM	UM	LH	LM	LH	UM

4. Irrigation Conditions
a) Name of Water Source

b) Irrigation Conditions

Rupingazi River	Nairobi River	Murubara/Gakuo River	Masinga Reservoir	Mariara River	Kathita-Monyi River	Thingithu River	Thangatha River	Ingu River
Water is available year round. But, Intake needs rehabilitation, which is damaged in 1992, and up to now not functional. Existing conveyance canal sited and breached in some parts. On five upper farmers are currently irrigating by sprinkler from an adjacent piped water scheme. Water distribution between up and lower parts is not well managed.	Intake is function. During February and August, river flow is low, and irrigation water is limited. Water is used for irrigation, livestock and domestic supplies.	Temporary intake made of stones and sticks are provided. But need rehabilitation of intake to ensure that adequate water is diverted. Canal is also need rehabilitation to minimize seepage losses.	No specific intake, portable pumps are used to lift irrigation water to field adjacent to the reservoir. Currently farming area is submerged by reservoir, farmers practicing recession cultivation as reservoir water recedes. This is illegal as the land belongs to TARDAs.	Permanent intake is provided at 2.5 km upstream from the schemes, supply pipe is only one inch in diameter. Water permit is not yet procured but application is submitted for supply pipe of eight inch in diameter. Irrigation season is Jan. to Mar. and July to Oct. during the dry spells.	Initiated by farmer, but given technical support by Ministry of Water Development. Irrigation season is from July to October, and from January to March. Irrigation pipe is so small of 0.5 to 4 inch. Each farmer is irrigating 0.1 ha. now solved and new agreement between contractor and farmers is expected April 8, 1998	Construction of intake and canal was started in 1995, but stopped in 1997 after disagreement between contractor of intake, Co-operative Bank, SISDO and farmers. Disagreement is now solved and new agreement between contractor and farmers is expected April 8, 1998	Irrigation started in 1989 by farmers themselves. But technical design assistance was from Ministry of water development. Initially, scheme intended to meet domestic water supply but later interest in irrigation development. Hence available water becomes insufficient for both uses.	The furrow belongs to a Irigu Coffee Factory (Chuka Farmers Co-operative Society), and the irrigation is only kitchen gardening although done illegally. No plan for irrigation the immediate future were reported. Illegal irrigation from furrow takes place during severe drought period for supporting kitchen garden growing Kale.
Initiated by government under rural development fund(RDF) in 1987, community excavated the canal. Active irrigation was from 1988 to 1992 when the intake was partially washed away.	Initiated by farmer Dutch (SIDP) support in 1985n	Project initiated in 1984 by Ministry of Health, and in 1992/93 MOA got involved.	Farmer started in small way using bucket when Masinga dam was closed in 1983.	Scheme started in 1971, when the community felt a need for having water for domestic use and irrigation.	Scheme started in November 1997.	Scheme started in 1982, but no progress until 1995 when discussion with MOA and SISDO started.	Scheme started in 1989 with assistance from the Methodist Church in collaboration with Lay Volunteers Association.	Not much was obtained regarding starting irrigation idea. MOA staff appeared to have verify the scheme.

c) Irrigation History

5. Land Resources and Crops

High land potential supporting coffee and tea. Cabbages, tomatoes French beans, maize	Originally designed for one farmer one acre (0.4 ha), but now some farmers are irrigating up to six acres. Tomato, onions, French beans, cabbages, maize	Land is relatively flat. Tomato, French beans, banana, maize	Land for irrigation is owned by TARDIA and irrigated without formal agreement. Irrigated land is not fixed, but moves to and from as the reservoir water changes. Tomatoes, French beans	Average land holding size is two hectare, out of which less than 0.2 ha per farmer is under irrigation. Tomatoes, French beans, cabbages, Kales, Carrots	Scheme is located in genera high potential tea zone. Average land holding size is 1.62 ha. It has scheme expansion plan to 51 farmers irrigation a total 80 ha. French bean, snow peas, onions, carrots, Potatoes, cabbage	Semi-arid area with unreliable rainfall. Extensive agriculture is done based on drought tolerant crops (millets, cotton, sorghum, katumani maize, cow-peas, green-gram, etc). Some 68.8 ha is expected to be irrigated with each farmer irrigation of 0.4 ha.	High potential tea and dairy zone. Land holding size is 0.8 ha per family on average. Presently 6 ha is irrigating, but planned to expand to 16 ha based on 0.2 ha per family. Tea, maize, Kale, cabbages.	Sloppy terrain and existing land under coffee and subsistence crop. Existing crops are coffee, maize and other subsistence crops.
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6. Farmers' Organization and Support Services

Originally, scheme member was 150 farmers. but under the ineffective management of committee, scheme split into an upper 50 group which is semi-active and lower 100 which is dormant.	Member of the scheme pay 200 Ks as annual subscription fee, and management committee is not effective. A member informant ignorant when last meeting was held, and now much in bank account.	Some 66 farmers are member of the schemes, and have elected 13 members into the management committee. Last few year organization is well managed.	Three farmers within the locality own pumps (3.5 HP 5 HP), which they hire out to other farmers at a cost of Ks. 200 per day with own fuel.	80 farmers in the schemes. Each farmer paid Ks 6,820 as entrance fee. No other charges are expected. Three persons are employed as water guard.	36 members constitute water project, and have a management committee of seven members. Members contribute 2,600 for buying pipes, and member fee is Ks. 1,200 per member.	Scheme has 170 farmers. There exist management committee of 15 members and group leader totaling to 30 members, half of which are women. Women group are fairly active and are engaged in building roof catchment tanks.	Scheme has 74 members an 13 of these constitute the management committee. Each member pays Ks. 3,000 joining fees. Some 64 members have paid the fees and are connected to water. Remaining 10 members have not completed payment but will be connected after completing payment.	Non-existent
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7. Marketing of Agricultural Crops	Initially, marketing arrangements are well organized with Makindu Growers, East African Growers(EGA), collecting horticulture produce. In 1992 intake was damaged, and farmers were discouraged and the scheme collapsed.	Market out-lets to Karatina, Nyeri and sometime Monbasa. Brokers/middlemen are not a problem. Occasionally two or three farmers collaborate to hire transport to market destination.	Schemes is located on both sides of tarmac road. Broker /middlemen active, and started to pose a few problems. Tomato, French beans, maize	Marketing is done individually, but no major activities and problems. Tomato, French beans	not far from tarmac road, 2 km away, but buyers usually come to farmers plot. However, no contract arrangements and farmers only accept what is offered by buyers, who also take long to pay.	No major marketing problems. But produce is delivered to middle-men at Kithaku Trading center. Delivery is done by donkey, ox-carts, bicycles, pick-up, matatus, etc.	Access road is very poor, which needs road up-grading and/or provision of bridge across Thingithu river. Contract marketing arrangements are known. But middle-men operating in neighboring Mitunguu Irrigation Scheme can be expected to assist.	Non-existence because no horticultural produce is available for sale.	
8. Main Constraints	Damaged intake, inadequate water, members conflict. Duo-member ship of some farmers to two projects complicates the organizational structure and requires harmonization.	During dry month of January/February and August/September water is not sufficient, allocation of available water not equitable, with farmers at canal end irrigating at the expense of tail-end farmer. Lack of input credit, wild- life damage.	Intake structure is not functional, canal seepage, water allocation not equitable and tail-end farmers unable to irrigate.	Fluctuating water level and abstraction point, and lack of sufficient number of powerful pumps to lift water to farmers fields.	Lack of capital to expand the schemes, technical design skills, technical skill in production and farmers organization.	Lack of capital, poor access roads, inadequate technical extension services, especially for pest and diseases.	Food insecurity, poor access roads, lack of bridge across Thingithu river to shorten distance to Mitunguu, limited employment opportunity, e.g. 60 % of young people go out of community to look for manual work.	Poor access roads, crop pests and diseases, food insecurity, insufficient money, relative low attendance of boys in local school.	Lack of authority to abstract from existing coffee factory furrow. This authority is unlikely to be given

- Size of proposed irrigation area (less than 100 ha)
- Accessibility to the site
- Project implementation background and ways (by government initiated or farmer initiated)

13.4 Classification of Smallholder Irrigation Schemes by Model Area's Type

The proposed smallholder irrigation schemes of 463 areas will be classified in accordance with five clusters of the formulated Model Areas (two types for implemented schemes and three types for expansion and new development schemes). Basic data used for these analyses are those obtained through District Profile Survey, which has been carried out during Phase-I field survey.

13.4.1 Criteria used for the Classification of Smallholder Irrigation Scheme

1) Implemented Schemes

The criteria applied for Model Areas of Type-A and B, which belong to the implemented schemes, are as follows;

Type-A

- Current irrigation area is more than 50 ha.
- Scheme has strong farmer's organization and organizational meeting is periodically and effectively held.
- Scheme is strongly managed by beneficiaries in the community.

Type-B

- Scheme has irrigation area more than one hectare.
- The farmer's organization is very weak and organizational meeting is not held effectively.
- Beneficiaries in the community do not effectively manage the scheme, due to weak organization of the community.

2) Expansion and New Development Schemes

Regarding the criteria for expansion and new development schemes such as Type-C, Type-D and Type-E, furthermore classifications of the types were made and following criteria were applied. In this formulation of the criteria, percentages of horticultural crop, which have been used as one of the criteria for selecting Model Areas, were not used, since those percentages are not different significantly among the schemes.

Type-C

C-1:

- Distance from the scheme to all weather roads is less than one kilometer.
- Construction cost per hectare is less than 13,200 Ksh/ha.

C-2:

- Distance from the scheme to all weather roads is less than one kilometer.
- Construction cost per hectare is more than 13,200 Ksh/ha.

Type-D

D-1:

- Distance from the scheme to all weather roads is in the ranges of two to six kilometers.
- Construction cost per hectare is less than 13,200 Ksh/ha.

D-2:

- Distance from the scheme to all weather roads is in the ranges of two to six kilometers.
- Construction cost per hectare is in the range of 13,200 to 266,700 Ksh/ha.

D-3:

- Distance from the scheme to all weather roads is in the ranges of two to six kilometers.
- Construction cost per hectare is more than 266,700 Ksh/ha.

Type-E

E-1:

- Distance from the scheme to all weather roads is more than seven kilometers.
- The scheme is located in the districts of Nyeri, Kirinyaga, Embu, Mbeere and Meru.

E-2:

- Distance from the scheme to all weather roads is more than seven kilometers.
- The scheme is located in the districts of Nyambene and Tharaka Nithi.

13.4.2 Results of Classification Study

Classification of smallholder irrigation schemes of 463 areas in accordance with the formulated five types of Model Areas was analyzed applying above-mentioned criteria of each type. The details of the analysis are given in Table O.1-6 to Table O.1-13 in Annex O.

Following table indicates the analyzed scheme numbers of Model Types by each district.

Analyzed Scheme Numbers of Model Types

District	Types									Total	
	Existing Schemes		Expansion and New Development Scheme								
	Type-A	Type-B	Type-C(1)	Type-C(2)	Type-D(1)	Type-D(2)	Type-D(3)	Type-E(1)	Type-E(2)		Type-X
Nyeri	6	1	6	19	7	12	6	12		1	70
Kirinyaga		2	8	10	3	5		5			33
Embu		2	6	20	9	6		5	1		49
Mbeere			6	2	6	1	1	12		1	29
Tharaka Nithi	1	1	5	4	8	3			26		48
Meru	5	6	29	22	33	33	9	54		5	196
Nyambene		1	5	2	5				25		38
Total	12	13	65	79	71	60	16	88	52	7	463

Note; Schemes classified into Type-X indicate the area being not available to be classified, because of insufficient data in the District Profile Survey.