

5.5.2 Family Farm Labor

According to the result of the farm economic survey conducted in the Phase I study, the averaged farm labor available per family is estimated at 3.56 persons and those of them are considered as full-time farm labor working about 300 days a year. Female labors account for about 48 percent of the farm labor, which implies importance of their role in farming activities.

5.5.3 Land Holding

As mentioned above, 98.7 percent of the farm households in the Study Area is categorized as the smallholders holding 1.95 ha on an average, which is smaller than 2.5 ha of the national average of Kenya. And there are some types of land holding, that is, freehold meaning absolute ownership, clan land owned by community etc. Other than these, there exists lease holders and landless farmers and squatters.

5.5.4 Crops Grown

Crops grown in the Study Area are composed of food crops, horticultural crops for exporting and local markets and some industrial crops such as coffee, tea and tobacco. The predominant crops in the Area are food crops such as maize and beans, however, some farmers who are living in coffee zone and grow mainly single crops such as coffee and tea etc. must buy maize from local market to meet demand in their family. Among seven (7) districts concerned to the Study Area, Kirinyaga and Meru are producing exporting horticultural crops as compared to other districts, and Nyeri and Meru have bigger producing areas for vegetables for domestic market including Irish potatoes compared to other districts, and those crops are grown by the smallholders. Banana is also important crop supplement food crops though depending on district. Embu has the biggest area to grow banana among seven (7) districts. Because of depending on rained farming, some divisions are supported in food supply through the government though it is depending on year.

5.5.5 Income and Expenditure

Farm household's income is varied depending on individual farm size, land use and socio-economic conditions. There exists disparity in income even in seven (7) districts of the Study Area as shown on the "Welfare Monitoring Survey (1996)", that is, 4,255 Ksh/household/month in Tharaka Nithi and 9,320 Ksh in Meru. However, these income level could be said still lower than 9,696 Ksh of the national average. According to the PRA, expense for food accounts higher percentage in the total expenditures. Currently, farmers have to sell their produces even at lower prices because they have not enough bargaining power to negotiate selling prices with traders, and prices of horticultural crops are fluctuating seasonally depending production and demand in markets.

5.5.6 Gender in Managing Property and Resources

Recently, it is said that women's status in the rural areas has been improved but still there exists gender issues caused by the traditional customs in rural families. For example, male (house head) has a right to manage and dispose lands, on the contrary, female (wife) has a right only to use lands. In addition, male has a right to manage all or most of household's income. Gender issue exists even in cropping and its

disposition on the basis of demarcation between male and female. Female traditionally grows and manage food crops like maize and beans and other vegetables such as sweet potatoes, banana, kale and cabbage etc. Male, on the contrary, manages cash crops such as coffee and exporting horticultural crops.

5.5.7 Self-Sufficiency of Food

The typical farm household in the Study Area holds 1.95 ha of farm land and 5.66 family members and some animals. In considering annual consumption of maize of 125.6 kg per capita, its productivity of 1,500 kg/ha and averaged farm size, the following would be estimated;

Production of maize: $1.95 \text{ ha} \times 1,500 \text{ kg/ha} = 2,925 \text{ kg}$

Demand for maize: $5.66 \text{ persons} \times 125.6 \text{ kg/capita/year} = 711 \text{ kg}$

Balance: $2,925 - 711 = 2,214 \text{ kg/year}$

According to the above estimation, family demand for maize could be attained by 1.95 ha of farm size. However, since the above calculation is based on the averaged farm size, yield and family size, condition must be changed by district and division basis, and if once a serious drought occur, self-sufficiency of maize might not be attained. For example, at least 0.5 ha per household will be necessary to meet family demand for maize, if based on 1,500kg/ha of yield. As described in the 4.1.3, Nyambene and Kirinyaga must import maize and beans from neighboring districts to meet internal demand.

5.5.8 Problems Confronted with Farmers

According to the result of PRA conducted in the Phase-I study, the common major problems among the seven (7) sites are insufficient irrigation water and low income. As to the constraints on developing irrigated horticultural farming, farmers pointed out, ① anxiety for repayment of project cost, ② improvement of marketing roads, ③ establishment of marketing group, and ④ improvement of storing facility. To overcome these problems and constraints and to promote horticultural farming involving producing food crops, supporting services ranging soft and hard aspects done by the governmental agencies, private sectors and NGOs are indispensable.

5.6 Analysis and Evaluation

The characteristics of the seven sites surveyed are different depending on altitude and orientation in relation to the mountains (whether on the wind-ward or lee-ward side). These two factors i.e. altitude and orientation, influence the rainfall pattern and hence agro-ecological potential.

1) Low Potential Areas

Four sites, Kiorimba, Nkui, Ruungu and Mashamba are located on the low potential Agro-Ecological Zones where rainfall is low and unreliable. Consequently, the farming system under rainfed conditions features drought-tolerant crops (cotton, sorghum, millet and cowpeas) with relatively low but more probable yields.

Land preparation is usually carried out by means of draft cattle while planting and weeding are done manually. Owing to risks associated with low and unreliable rainfall, use of purchased farm inputs (improved seed, fertilizer) is limited.

Where irrigation is available, the cropping pattern becomes broadened to include such crops as sugarcane, arrow-roots and a wide range of horticultural crops. In this case, use of purchased inputs is fairly common.

Communities living in these areas have a relatively higher incidence of poverty and have frequently been stricken by famine, particularly in areas having no access to irrigation water. These communities therefore appear to present a strong case for support in developing irrigation water facilities since this would remove one of their critical constraints in agricultural production. In getting such support, however, the communities will face two problems. One, their saving capacities are low and they may not be able to make a substantial cash contribution (the delay case of Ruungu is an example). Second, the communities are relatively far from market destinations and access roads are poor. So even if suitable loan arrangements were worked out the irrigation community would face difficulties in servicing the loans for lack of profitable markets.

2) Medium and High Potential Areas

The three other (Island farm, Kibirigwi, Ruringazi) sites are located in areas of relatively high agricultural potential where important cash crops such as coffee, potatoes and vegetables can be grown under rainfed conditions. There are dry season spells which limit agricultural potential of these areas. With installation of irrigation facilities, there is a notable increase in cropping range as well as continuous cultivation throughout the year.

The areas have a comparatively lower incidence of poverty. They are, however, nearer market destinations, have a network of reasonable rural roads and have communities with considerable saving capacity. For a cost sharing irrigation strategy, these areas appear attractive.

3) Gender Analysis

According to the study results of Socio-Economic survey and PRA survey conducted by the Study Team, women are responsible for providing the majority of agricultural labor while in the country as whole, women are estimated to contribute about 70 per cent of rural labor requirements. In addition, they are responsible for the bulk of domestic household tasks such as cooking, fetching water and firewood, attending to children and the sick. On the other hand, men are responsible for opening cultivation land, cash-crop pruning and spraying as well as managing livestock out-side the homestead.

On balance, however, the gender division of labor is imbalanced and female members of the household are overburdened. This over-contribution of women to agricultural labor requirements is, regrettably, not compensated by receipt of commensurate agricultural benefits. As a general rule, male members of the household tend to either control or take a bigger share of household agricultural benefits. For instance, when the household cash budget is limited, as it usually is, the needs and wants of male members of the household would take precedence. This is so even when female members were largely

responsible for realizing that cash budget. There are exceptions, of course, and as mentioned elsewhere in the report, there is significant variation among the seven study districts .

Of more significance is the ownership pattern of the most important household resource i.e. land, where the majority of women are excluded although they have user rights through their connection to the husband, father or male relative.

This gender issue in rural development is increasingly receiving considerable policy attention and recently the Ministry of Agricultural inaugurated a “Gender Equity and Mobilization Unit ” to be part of the Extension and Adaptive Research Division.

The above gender analysis has implications on the proposed “Community-Based Smallholder Irrigation Development Project for Promotion of Horticultural Production”. In order to make its contribution for the project in addressing the existing gender imbalance, it will attempt to do the following:

- To adopt a participatory approach that will permit women feelings and concerns to be articulated and incorporated into the planning and implementation process,
- To seek out explicitly technical packages that will be women-friendly e.g. irrigation design and cropping patterns that include crops traditionally controlled by women,
- To provide for institutional mechanisms for permitting women to access relevant information and technology (e.g. marketing, extension messages) and
- To encourage change of traditional attitudes towards women among communities being supported by the “Project”,

4) Assessment of Poverty and Other Disadvantaged Groups within a Community

The following table shows poverty incidence and ratio of landless households at the district level;

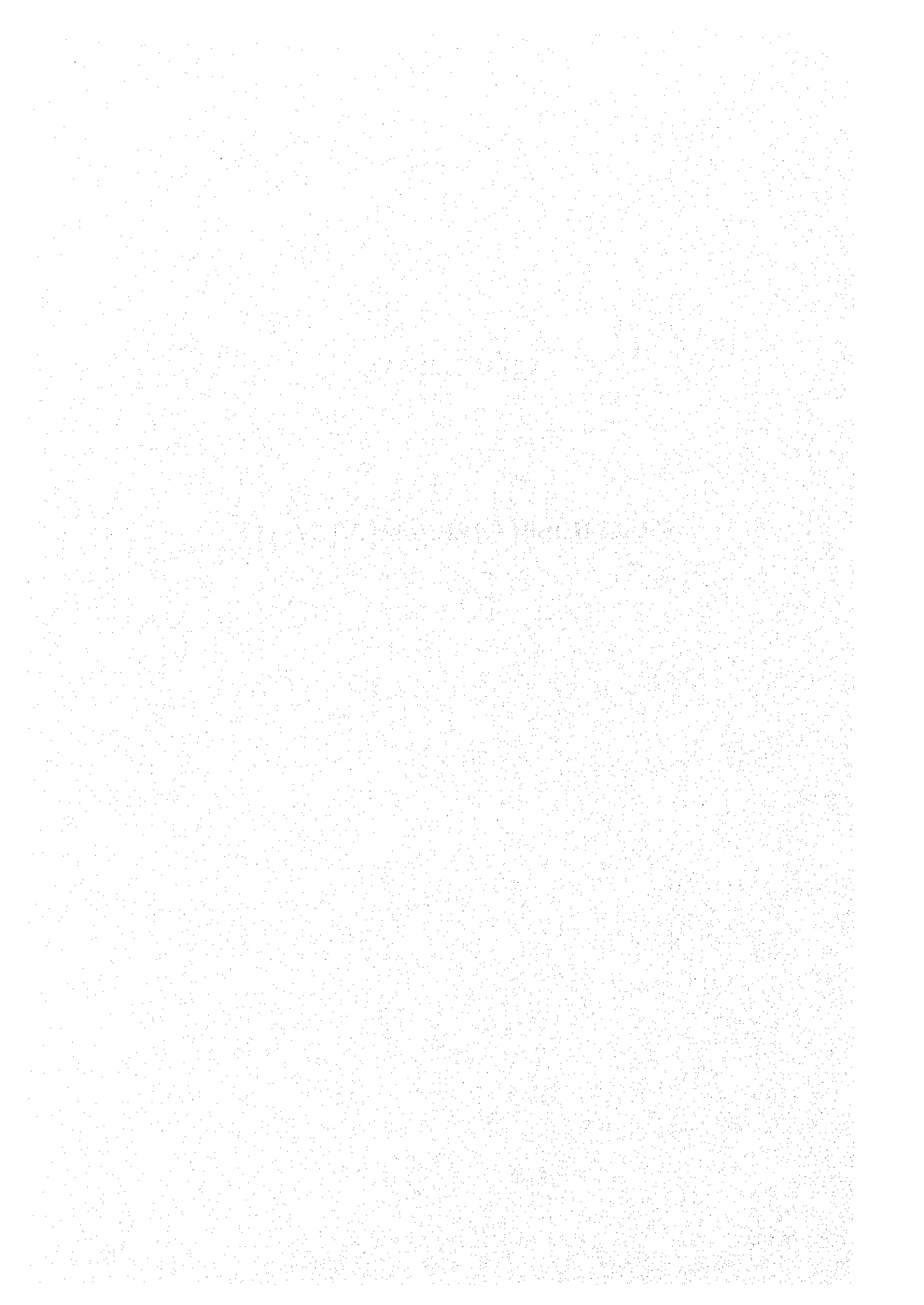
	Poverty Incidence		
	Population	Household	Landless Household
Kirinyaga	34.7	28.2	18.8
Nyeri	20.3	29.8	20.0
Embu	60.9	64.6	15.7
Meru	39.3	46.7	3.5
Tharaka Nithi	46.7	48.0	0.2

Source; Economic Survey 1997 and Welfare Monitoring Survey 1994

Most of the farmers (98.7 %) in the Study Area are classified as small-scale farmers and their farming is considered subsistence, living on the poverty line as show above. In addition, the existence of landless households must be taken into consideration in planning.

CHAPTER VI.

SMALLHOLDER IRRIGATION SYSTEM



CHAPTER VI. SMALLHOLDER IRRIGATION SYSTEM

6.1 History of Smallholder Irrigation System Project

The Smallholder Irrigation Schemes (SIS) Project was initiated in January 1977 with technical assistance from the Netherlands and ended in June 1994. In the course of these periods, smallholder irrigation schemes could be classified into two project names in accordance with the implementation stages, that is, Small Scale Irrigation Development Project (SSIDP) for Phase-1 to Phase-4 stages and Smallholder Irrigation and Drainage Project (SIDP) for Phase-5 stage.

The major contents of technical assistance in each phase mentioned above are summarized as follows;

- Phase-1 Stage (1977-1980) : Establishment of four Provincial Irrigation Units in Kisumu, Mombasa, Nakuru and Nyeri in order to reinforce the institutional and operational arm of the already on-going SSIDP. And, also the Irrigation and Drainage Branch (IDB) in the Land Development Division was physically assisted to start as an executing organization with office, transport and logistic support for Nairobi Headquarters.
- Phase-2 Stage (1981-1984) : Technical assistance was limited to Headquarters and three Provincial Irrigation Units. And, several irrigation and drainage schemes were supported technically and financially. These schemes are Kibirigwe Irrigation Scheme, the Lower Tana Village Irrigation Program (LTVIP), and the Kisii Valley Bottom Development Program (KVDP).
- Phase-3 Stage (1984-1987) : Activities were concentrated in three Provinces; Nyanza, Rift valley and Coast, and the number of expatriates was reduced, and emphasis was on-the-job-training, formulation of guideline, course development and preparation of manual.
- Phase-4 Stage (1988-1990) : Deterioration of schemes, where farmers were not maintaining their own schemes was avoided. This was achieved by contracting professional community organizers. NGOs activities to assist farmers in their scheme organization were begun. Profitability of various irrigated crops in smallholder irrigation was investigated. Guidelines for farmers' contributions (cost-sharing) towards implementation of own schemes were prepared based on the expected profitability.

6.2 Achievement of Smallholder Irrigation Development Project (SIDP)

Phase-5 Stage (1991-1994) : Institutional strengthening of IDB was made by restructuring IDB to a professional executing agency providing services to smallholder irrigation farmers was made. Formulating and starting a loan program was undertaken to assist individual smallholders to acquire irrigation equipment. Cost recovery approach for group-based gravity horticultural schemes was formulated.

6.3 Basic Approach to SIS Implementation and Role of the Government, NGOs and Farmers' Organization

6.3.1 Basic Approach to SIS Implementation and Role of the Government

The basic approach to SIS implementation and role of government could be explained in the following project cycle (refer to Figure 6.3-1);

1) Project Initiation

The idea for the project originated from the local community, and request for assistance will be proposed by an organized group or the local leaders. In this step, the "felt need for project implementation" by the population or a part of the population will be essential.

2) Field Visit and Basic Data Collection

Pursuant to the project initiation mentioned above, field visits will start to collect existing data, and a first appraisal of the situation will be made. To facilitate the data collection, a checklist will be prepared by senior irrigation staff. A field report will be prepared indicating development possibilities and expected constraints.

3) Project Profile - Preliminary Report

Through the field visit mentioned above, when the project is proved to be possible, more detailed data collection such as climate, river discharge and topographic map will be collected and annualized. A Preliminary project plan and design will be prepared, broadly describing how the project will be supported, technically, and what structures will be needed, etc. Furthermore, the proposed organizational set-up will be described, and it should be indicated whether and how the farmers can manage the scheme by themselves. The report will also indicate the necessity of further actions and investigation.

The farmers' participation, organization and the ability to stand on their own are important. An estimation for outside help requirement and its duration, which will be needed after the project implementation, should be made.

A preliminary cost estimate will be prepared, which shows the cost for technical works, farmers' contribution and cost for operation and maintenance.

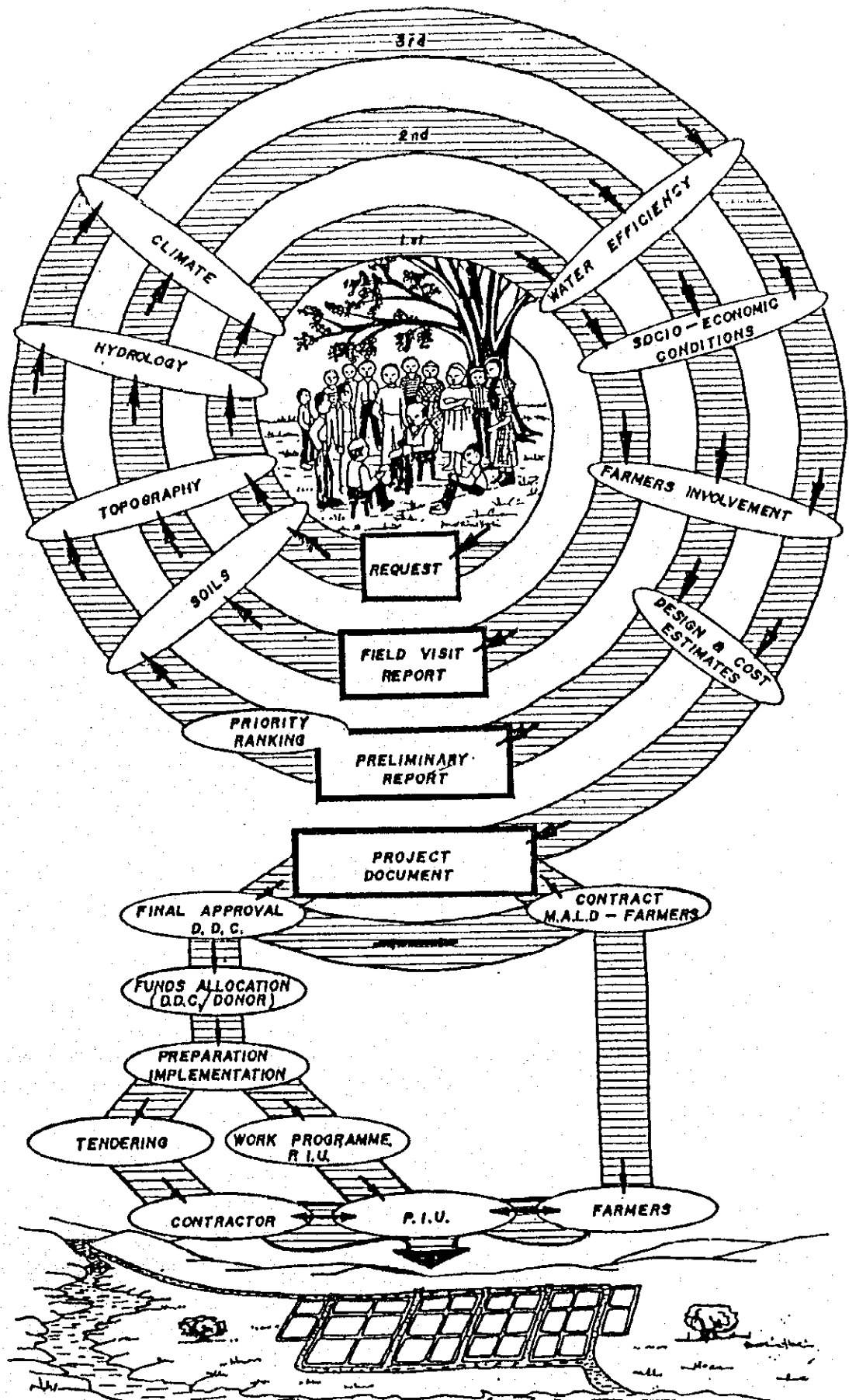
4) Priority Ranking

The initial project ideas will most probably be submitted to the irrigation staff in the District and Province through the Divisional Development Committee that may set their local priorities. During the preparation of the project profile, it will be essential to discuss with the members of this Committee.

The project proposal (profile) will be compared with other development proposals, which have been made in the District. The priority ranking will be made by the Executing Committee of the District

Figure 6.3-1

Overview of Project Procedures to be Followed



Source : "Scheme Identification and Evaluation" Report prepared by MOALD, 1986

Development Committee (DDC) ideally taking into account the criteria presented in the guidelines for irrigation development and any other relevant criteria pertaining to the District.

The irrigation staff in the District and Province will prepare for all smallholder irrigation projects in each District a priority ranking based on the preliminary investigations in cooperation with the Executing Committee.

5) Conditional Approval

These irrigation projects will be discussed first by the DDC. The DDC will review all development proposals, and make any necessary changes to the priority rankings and endorse the portfolio of the projects to be submitted to the different Ministries.

6) Final Document - Scheme Document

The final planning will result in a more detailed project document, including the final design, costing and the different feasibility tests, indicating below;

- Socio-Economic : Will the project works be as expected and serve the need of the community ?
- Technical : How will the project work, possible constraints, operation and maintenance, organizational set-up?
- Institutional : Who will supervise the construction and assist the farmers? Over what period time is assistance required after completion of the project and are funds sufficient?
- Financial : Funds available in the DDC, contribution made by farmers and donor funds. Distinction is to be made between investments, overheads during the study and the implementation and current cost.

The required funds have to be incorporated in the budgets of the ministry concerned. Often the project implementation will not be completed within one financial year. The budgeting should reflect an annual amount, which can be absorbed by the local community and the supervising party.

7) Final Approval

The final project proposals, which should be in compliance with the guidelines of the Ministry, will be submitted to the DDC for their approval. The DDC will forward the proposals, when approved, to the respective Ministries.

8) Implementation

Project implementation can now begin. In the step-by-step approach, a part of the project will be implemented. When successful and if the farmers can handle the project, the next step will be carried out.

9) Additional Study

The more difficult the project, the more additional studies will be required before one can assume that the project will start. In general, such additional study should be made before the project proposal will be submitted to the Executive Committee. The need for additional studies, therefore, increases the period of time required to begin project the implementation.

10) Monitoring

The progress of the project will be monitored and constraints which occur will be cleared. The monitoring system should be simple and handled by the project field staff and extension staff of the Ministry.

6.3.2 Role of Non-Government Organizations

In parallel with "Project Initiation" works mentioned above, Non-Governmental Organization (NGOs) will start farmers' training on the following topics;

- Development of cost recovery under the condition of group-based project,
- Saving to create development fund, and
- Management for operation and maintenance of project.

The following indicates typical scheme development procedure to be taken by NGOs for group-based smallholder irrigation and drainage project.

	Activities	Remarks
(1)	Introductory meeting	: NGOs introduced to the area
(2)	Leader meeting	: NGOs, local leader and scheme committee meeting
(3)	First general meeting	: NGOs and all scheme members meeting
(4)	Second general farmers meeting	: NGOs and all scheme members meeting, and signing of memorandum of intention of cooperation
(5)	Group formation/election of interim	: Evaluation of demand, and training of group leaders member on group loaning and formulating governing by-laws
(6)	Opening of account for security fund	: A joint account between NGOs and farmers deposits/ depositing security fund
(7)	Interim leader workshop	: Training on project leadership/management skills/formulation of scheme by-laws
(8)	Monthly meeting/security fund	: Security fund monitoring/checking and discussing group dynamics and solving of group problems
(9)	Design meeting	: Discuss with farmers about alternative design and shows the farmers the technical aspect of the project and cost implications
(10)	Tender/quotations	: Invite quotation/tender. Farmers select a supplier and contractor
(11)	Signing of loan agreement forms	: Scheme committee and frames sign estimated project costs
(12)	Guarantee security approved by NGOs	
(13)	Loan approved by Cooperative Bank	
(14)	Construction/supervision of facilities	
(15)	Signing of final loan forms	
(16)	Grace period	: Farmers grow first season crop
(17)	Loan repayment/monitoring of repayment:	
(18)	Release of chattel mortgage on intake	: Possible if loan repayment is over

6.3.3 Role of Farmers' Organization

Farmers' participation is essential for scheme implementation to proceed, and major farmers' role in these steps are as follows;

- Farmers make a request for assistance.
- The memorandum of intention for cooperation (.) is drawn up, specifying the deposit of a security fund for loan, and other farmers' contributions during the preparation phase (the words with marks of asterisk (*) are milestones, where 70 percent of the farm households have to be present.
- Farmers in the scheme, organized in groups, take the initiative of depositing security fund installments, finalizing membership lists, and choosing interim leaders.
- In a series of design meetings (.), scheme layout, operation and maintenance requirement and farmers' contributions are discussed, based on various alternatives. The farmers make decisions, which are finalized in the next step.
- An implementation agreement is signed by both the farmers and the government staff, identifying the alignment of canals and drains, and specifying the tasks of both the farmers and the irrigation staff.
- Farmers contribute toward the completion of their required security fund deposits and/or in the excavation of canals and drains.
- A loan agreement is signed by a NGOs or other financial institution, and the scheme is backed by loan applicants of individual households to their groups, and of the groups to the scheme.
- After their agreement contribution is finalized, tenders or quotations for implementing structures and/or pipelines will be awarded.
- The handing over of the irrigation infrastructure is made, after implementation is completed.
- The farmers' organization manages the operation and maintenance of the irrigation infrastructure.
- The scheme, through its groups and individual households, pays back the loan in monthly installments.

6.4 Guideline/Design Standard/Manual for Implementation of Scheme

For the implementation of smallholder irrigation schemes (SIS), following guidelines, design standards and manuals have been prepared by IDB, MOALD;

- Structures Manual (Part 1-Part 7) for senior IDB staff (IDB 1984)
- Guidelines on Smallholder Irrigation Projects in Rural Development (IDB 1986)
- Schematic Identification and Evaluation ; Manual for Senior Staff on Gravity-fed Schemes with Basin Irrigation Operated by Farmers (IDB 1986)
- Criteria, Guidelines, Procedures, Design and Proposal Formats (IDB 1990)
- Guidelines on Smallholder Irrigation Project for Implementing Agencies and Donors, April 1993

6.5 Organisational Capability Assessment of Irrigation and Drainage Branch and NGOs

6.5.1 Irrigation and Drainage Branch

1) Major Works and Staff of Irrigation and Drainage Branch

The Irrigation and Drainage Branch (IDB) is responsible for the following works;

- Provision of irrigation and drainage services,
- Development and Provision of irrigation and Drainage guidelines,
- Identification, planning, design and supervision of implementation of smallholder irrigation, and drainage schemes,
- Training of irrigation staff on water management and other technologies and
- Training of farmers on farm water management and formation of water users associations.

In all the above functions, the farmers are the key players as they are responsible for operation and maintenance of the scheme. In order to provide services, the following is the organisational set up. Following table shows the assigned staff for Irrigation and Drainage Branch (IDB).

- Irrigation and Drainage Branch
- Seven District Irrigation Units
- District Irrigation Units

Assigned Technical Staff for Irrigation and Drainage Branch (IDB)

Staff Cadre	ADA	SAO	SAE	AE	AO	AAO	Total
Irrigation and and Drainage HQ	-	2	4	1	1	-	8

Central Prov.							
PIU	-	-	1	1	-	-	2
DIU	-	-	1	6	-	16	23

Rift Valley Prov.							
PIU	-	-	-	5	1	2	8
DIU	-	-	-	15	-	14	29

North Eastern Prov.							
PIU	-	-	-	1	-	2	3
DIU	-	-	-	3	-	6	9

Coast Prov.							
PIU	-	1	-	1	-	1	3
DIU	-	-	-	5	-	10	15

Nyanza Prov.							
PIU	-	-	-	5	-	2	7
DIU	-	-	-	8	-	13	21

Eastern Prov.							
PIU	-	-	-	3	1	1	5
DIU	-	-	-	7	-	23	30

Western Prov.							
PIU	-	-	1	1	-	-	2
DIU	-	-	1	3	-	6	10

Total	-	3	8	65	3	96	175

In order to improve on the staff capability the IDB has been organising the following short courses, however the courses have not been organised since 1995 and there is a backlog of new staff who need to be trained.

- Scheme identification
- Scheme design
- Implementation of Structures
- Establishment of farmers organization
- Training of Trainers
- Contract Management

2) IDB Capability Assessment

The circumstances of Irrigation and Drainage Branch (IDB) from viewpoints of project implementation for the smallholder irrigation schemes could be summarized as shown below, based on the previous descriptions in the paragraph of 3.3.3 "Budget Status and Personnel" and also above descriptions of "Major Works and Staff of IDB".

- Out of the MOALD budgets of 281.9 million Kenyan Pound, which is an average for the periods of three years from 1994/95 to 1996/97, an allocated average budgets for irrigation development project were so small with 3.1 million pound, which is equivalent to one percent of the MOALD budgets of 281.9 million Kenyan Pound.
- Total recurrent budgets of IDB in 1997/98 were 925 thousand Kenyan Pound, and the personnel and their related expenses occupy 72 percent of these recurrent budgets. On the other hand, IDB development budgets decreased broadly in 1,220 thousand Kenyan Pound in 1997/98, which is equivalent to 35 percent to the 1994/95 development budgets of 4,029 thousand. Most of the budgets of 1,220 thousand Kenyan Pound had to be provided by local budgets of Kenyan Government.
- Out of these development budgets, civil work budgets to be used mainly for canal construction occupy 1,140 thousand Kenyan Pound. However, due to the broad reduction of other necessary expenses to be needed to implement the project, irrigation and drainage works under the IDB are slow down and not progressive, even though civil works budgets had been secured. Under the situation, annual progress of irrigation and drainage projects is reported to be about 60-70 ha in the whole country.
- Authorized numbers of MOALD technical government staff are about 10,900. Out of this numbers, total numbers of technical government staff in IDB stationed in Central Office, Provincial and District Irrigation Units are 175 (average 3.3 staff in district), and this number is deemed to be extremely low compared with the MOALD total technical staff.

Under the situation, large-scale project implementation by the supervision of IDB could not be expected, and it will be considered that annual scale of project implementation would be about 100 ha.

6.5.2 Non-Governmental Organisations

1) Active Non-Governmental Organizations (NGOs)

Followings are the Non-Governmental Organizations which are involved in Smallholder Irrigation.

- Smallholder Irrigation Scheme Development Organization (SISDO)
- Smallholder Irrigation Support Organization (SISO)
- Kenya Freedom from Hunger Council (KEFHC)
- World Vision International
- Food for Hungry International
- Terra Muova
- Action Nor Sud
- Plan International
- Church-Based Organisations, e.g. Catholic Diocese

Other than SISDO all the NGO's have to rely on the Ministry of Agriculture for Technical Support.

At the scheme level there are water users associations and committees, which are organised for the operation and maintenance of the irrigation schemes. It is therefore imperative that the associations and farmers committees are adequately trained.

2) NGOs Capability Assessment including SISDO

Since inception of Smallholder Irrigation Scheme Development Organization (SISDO) in 1992, SISDO has been undertaking the development and improving the economic status of smallholder farmers through i) delivery of credit services for development of smallholder irrigation project consisting of group-based gravity irrigation and individual pump-fed irrigation schemes, ii) farm inputs for horticultural farming, iii) zero grazing (dairy cows), etc.

Table 6.5-1 indicates the major activities of SISDO for five years from 1993/94 to 1997/98, and also income and expenditure accounts. As is seen in the table, SISDO activities in 1997/98 is only one scheme for irrigation infrastructure project with project costs of 10.2 million Kenya shilling, due to economic constraints. Furthermore, surplus of income over expenditures has been increased rapidly from the year of 1996/97, resulting in current SISDO's tight financial conditions. So, SISDO has decided to suspend temporarily funding new project until the situation improve, and is concentrating on loan recovery the funds from which the already organized and qualified groups can benefited. The implementation of new schemes will depend on new donor's funds to be expected and recovered loan from loan groups.

Presently, total number of the organization staff is 21, which comprises management, technical and administration staff, and eight board of directors, totaling 29 staff.

Under the situation, organizational function of SISDO deems to be weak as the main project implementation body, therefore it is considered that strengthening of implementation body of NGOs including SISDO, which include technical and financial aspects, will be needed for effective implementation of the smallholder irrigation schemes.

Table 6.5-1 Achievement of SISDO (1993/94-1997/98)

	1993/94		1994/95		1995/96		1996/97		1997/98		Total													
	No.	Acraege (ha)	Cost ('000Ks)	Beneficiaries	No.	Acraege (ha)	Cost ('000Ks)	Beneficiaries	No.	Acraege (ha)	Cost ('000Ks)	Beneficiaries												
1. Achievement																								
Irrigation Infrac.	0	0	0	0	2	18	959	75	2	28	3,300	96	1	54	10,200	135	5	100	14,459	306				
Pump-fed Project	4	10	3,531	25	2	3	930	8	1	1	213	3	0	0	0	0	7	14	4,674	36				
Farm Input	13	131	2,312	325	10	101	1,359	250	22	222	3,146	550	10	100	1,394	250	0	55	554	8,211	1,375			
Zero-Grazing	0	0	0	0	0	0	0	0	1	17(cow)	352	7	328(cow)	979	28	0	0	4	1,331	35				
Total	17	141	5,843	350	12	104	2,289	258	26	241	4,680	635	15	128	5,673	374	1	54	10,200	135	71	668	28,685	1,752
2. Income and Expenditure Account ('000Ks)																								
1) Total Income			24,678				18,562				8,500					7,080					58,820			
Donor Funds			13,806				10,826				1,057					1,290					26,979			
SIDP			14,973				8,946				645					150					23,919			
DANIDA			1,511				450				300										2,766			
Terra Nouva			375				1,430														1,430			
Belgium																								
Funds recalled by Donars			-3,053													1,140					-3,053			
ASAL																					1,140			
Other Country			10,672				7,736				112					5,790					31,841			
Other											7,443													
2) Total Expend.			12,125				18,748				17,890					13,657					62,420			
Salary, Wages			2,247				3,894				3,213					4,790					14,144			
Project Implementation			8,052				13,530				14,677					8,867					45,126			
Debts Provisions			1,826				1,324														3,150			
3) Surplus of Income over Expenditure			12,553				-186				-9,390					-6,577					-3,600			

Source: SISDO

6.6 Existing and Potential Area of SIS in the Study Area

6.6.1 Irrigated Area by District

District profile up-date survey work has been carried out since the beginning of October 1997 with assignment period of one and half months to update the previous study which was done in the period from 1992 to 1995. The terms of reference of the study is shown in Annex D.

Currently, irrigated agriculture is being carried out by four sectors: namely group-based smallholder irrigators (GSI), individual irrigators (II), National Irrigation Board (NIB) and River Basin Development Authority (RBDA). The total irrigated area is about 15,400 ha. The occupation rate of the area by each sector and the irrigated area by district are shown in Table 6.6-1.

The occupation rates of irrigated area for GSI, II, NIB and RBDA are 45, 13, 38 and 5 percent, respectively. The major part (83%) of irrigated area is managed by group-based smallholder irrigators and National Irrigation Board.

The district distribution ratios of the irrigated area are Nyeri (11%), Kirinyaga (45%), Embu (0%), Mbeere (12%), Tharaka Nithi (2%), Meru (26%) and Nyambene (4%). The irrigation developments in Kirinyaga and Meru districts are advanced, while the developments of Embu and Tharaka Nithi districts are stagnated. It is noted that Mwea irrigation project managed by NIB is located in Kirinyaga district and the 83 percent of the irrigated area in the district is occupied by this project.

6.6.2 Existing Area of Smallholders Irrigation Scheme

According to the result of District Profile Up-date Survey Work (1997), the number of Smallholder Irrigation scheme (SIS) count of 463 schemes and increases by 137 schemes comparison with the previous District Profile Survey (1992-'95) execute by IDB. The total proposed area is about 64,000 ha presently. Out of this, the area of 6,900 ha, which is equivalent to 11 percent the total proposed area, is deemed to be irrigated.

The district distribution of irrigation area of SIS is shown in the table below and Table 6.6-1. Out of seven districts, the development of SIS is advanced in Meru and Nyeri districts and is stagnating in Mbeere and Tharaka Nithi districts.

Since the number of irrigation schemes and currently participating farmers' households amount to 250 and 36,000 respectively, the average irrigated area per scheme and per household are as small as 28 ha and 0.2 ha, respectively (see Table 6.6-1).

The individual details of each scheme, such as location, irrigation area and number of farmers households, are shown in Annex L.

Table 6.6-1 Irrigated Area by District and the Distribution in the Study Area (1997)

District	Executor of Irrigation Scheme						Total (ha)	Area of Distri. of Irrig'd area (%)
	Group-based Small-holders		Individual		National Irrig. Board (ha)	River Basin Dev. Autho. (ha)		
	(ha)	(%)	(ha)	(%)				
Nyeni	1,381	20	300	15	-	-	1,681	11
Kirinyaga	750	11	405	20	5,800	-	6,955	45
Embu	56	1	12	1	-	-	68	0
Mbeere	175	3	928	46	-	710	1,813	12
Tharaka Nithi	189	3	50	2	-	-	239	2
Meru	3,889	56	189	9	-	-	4,078	26
Nyambene	479	7	126	6	-	-	605	4
Total	6,919	100	2,010	100	5,800	710	15,439	100
(%)	45	-	13	-	38	5	100	-

Source) District Profile Up-date Works 1997 JICA

Distribution of Irrigation Area by District

	Irrigated Schemes		Unirrigated Schemes		Total	
	No. of Scheme (nos)	Area (ha)	No. of Scheme (nos)	Area* (ha)	No. of Scheme (nos)	Area (ha)
Nyeri	31(25)	1,381	39(20)	7,761	70	9,142
Kirinyaga	19(15)	750	15(8)	3,499	34	4,249
Embu	17(8)	56	31(21)	852	48	908
Mbeere	20(5)	175	9(3)	2,494	29	2,669
Tharaka Nithi	13(10)	189	35(30)	6,615	48	6,804
Meru	119(91)	3,889	77(60)	31,806	196	35,695
Nyambene	31(27)	479	7(3)	4,036	38	4,515
Total	250(181)	6,919	213(145)	57,063	463	63,982

Figures in parenthesis are result in previous District Profile Survey (1992 - '95 IDB)

Note; * The figures include the unirrigated area in partially irrigated schemes.

6.6.3 Present Status of Fully-Irrigated Area

1) Status of Irrigation Facilities

According to the survey results of "Up-date Work", the status of irrigation facilities of the actually irrigated 250 irrigation schemes are characterized as below:

- Water intake of river water is operated by the way of concrete and masonry weirs. The accommodated schemes (concrete weirs) are only 45 percent of the total number of irrigation schemes. The remaining schemes have temporary weirs and are obliged to unstable water use.
- As a canal type, pipeline, open channel type and combined type of pipeline and open channel are used in the Study Area. The pipeline type is adopted in 102 schemes and the open channel type seems to be used in the remaining major part of the schemes.
- As an irrigation method, sprinkler and furrow irrigation methods are adopted. The sprinkler method is popular in Nyeri and Meru districts where irrigation development are advanced.

Present condition of irrigation facilities in current irrigation schemes is shown in Table 6.6-3.

2) Present Status of Operation and Maintenance of Irrigation Facilities

The operation and maintenance (O&M) works for irrigation facilities is to be executed by water users association (WUA) which is one of the farmers' organization. However, the strength of organization of WUA is generally poor except those in a few irrigation schemes, and the O&M works in most schemes are not fully achieved. In a few schemes with a strong WUA, the members of WUA participate in canal clearance works several times annually and pay the water charges for O&M works by 100 to 600 Ksh per household, annually.

3) Present Problems and Constraints

Present problems and constrains for the promotion of the SIS are as follows:

- The SIS irrigation potentials of the Study Area is 11,500 ha. Out of this, the area with existing irrigation facilities is 4,800 ha, the remaining area of 6,700 ha have not irrigation facilities. The existing irrigation facilities, which were constructed by limited construction funds and then have low capacity, shall be rehabilitated.
- Some data of District Irrigation Profile updated in Phase-I field work in 1997 are not accurate due to the immaturity of scheme planning. The fact was found out through Phase-II and Phase-III field works, and it prevents the MOALD from formulation of detailed plan for SIS promotion.
- All WUAs are not fully developed in the existing irrigation schemes, and in case some schemes have organizations of WUAs, the organization are generally weak, then O&M works of irrigation facilities and water distribution are not executed properly. Moreover, some existing schemes have not water permit.
- Extension services on irrigated agriculture and water management are rather low level due to the lack of fund for travel expenses and allowance and training to Front-line Extension Worker (FEW).

6.6.4 Agricultural Land Potential in the Study Area

The agricultural area mainly extends at 2,400 m downwards. The potential is classified in three types by annual rainfall: high, medium and low. The potential area amounts to 1,183 thousand ha in total which is equivalent to 68 percent of the total area, as shown in Table 6.6-4.

Table 6.6-2

Present Situation of Smallholder Irrigation Schemes (SIS)

(1) Number of SIS

District	Irrigated			Unirrigated			(7)=(3)+(6) Total (nos)
	(1) Fully	(2) Partially	(3)=(1)+(2) Sub-total	(4) Partially Implemented	(5) Not Implemented	(6) Sub-total	
	(nos)	(nos)	(nos)	(nos)	(nos)	(nos)	
Nyeri	15	16	31	18	21	39	70
Kirinyaga	2	17	19	1	14	15	34
Embu	0	17	17	25	6	31	48
Mbeere	0	20	20	1	8	9	29
Tharaka Nithi	2	11	13	4	31	35	48
Meru	3	116	119	44	33	77	196
Nyambene	0	31	31	2	5	7	38
Total	22	228	250	95	118	213	463

(2) Irrigation Area of SIS by Project Status

District	Fully Irrigated Scheme (1) (ha)	Partially Irrigated Scheme			Unirrigated Scheme (5) (ha)	Total (6)=(1)+(4)+(5) (ha)	Actually Irrigated (7)=(1)+(2) (ha)
		Existing (2) (ha)	Unirrigated (3) (ha)	Sub-total (4) (ha)			
Nyeri	780	601	1,458	2,059	6,303	9,142	1,381
Kirinyaga	142	608	1,409	2,017	2,090	4,249	750
Embu	0	56	311	367	541	908	56
Mbeere	0	175	909	1,084	1,585	2,669	175
Tharaka Nithi	104	85	646	731	5,969	6,804	189
Meru	423	3,466	18,531	21,997	13,275	35,695	3,889
Nyambene	0	479	2,666	3,145	1,370	4,515	479
Total	1,449	5,470	25,930	31,400	31,133	63,982	6,919

(3) Participating Household

District	Household		(3)=(1)/(2)*100 Ratio of Irrigating HH (%)
	(1) Irrigating (hh)	(2) Proposed (hh)	
Nyeri	5,435	39,600	14
Kirinyaga	1,557	6,486	24
Embu	442	3,960	11
Mbeere	1,062	4,136	26
Tharaka Nithi	650	9,720	7
Meru	24,704	105,471	23
Nyambene	2,311	8,379	28
Total	36,161	171,860	21

(4) Average Irrigated Area per Scheme and Household

District	(1) Irrigated Schemes (nos)	(2) Irrigated Area (now) (ha)	(3) Irrigating Household (hh)	(4)=(2)/(1) Average Irrig'd Area (ha/scheme)	(5)=(2)/(3) Average Irrig'd Area (ha/hh)
Nyeri	31	1,381	5,435	45	0.3
Kirinyaga	19	750	1,557	39	0.5
Embu	17	56	442	3	0.1
Mbeere	20	175	1,062	9	0.2
Tharaka Nithi	13	189	650	15	0.3
Meru	119	3,889	24,704	33	0.2
Nyambene	31	479	2,311	15	0.2
Total	250	6,919	36,161	28	0.2

Table 6.6-3 Present Condition of Irrigation Facilities of Currently Irrigated Schemes

(1) Intake Facilities

	Temporary Weir (project)	Permanent Weir (project)	No Data (project)	Total (project)
Nyeri	4	22	5	31
Kirinyaga	14	5	0	19
Embu	7	2	8	17
Mbeere	1	1	18	20
Tharaka Nithi	6	4	3	13
Meru	36	68	15	119
Nyambene	16	10	5	31
Total	84	112	54	250

(2) Water Conveyance and Distribution System

	Open Channel (OC) (project)	Pipeline(P) (project)	OC+P (project)	No Data (project)	Total (project)
Nyeri	4	18	5	4	31
Kirinyaga	15	3	0	1	19
Embu	12	0	1	4	17
Mbeere	3	1	0	16	20
Tharaka Nithi	5	1	0	7	13
Meru	0	69	0	50	119
Nyambene	9	10	1	11	31
Total	48	102	7	93	250

(3) Terminal Facilities

	Sprinkler (project)	Bucket/ Furrow (project)	Total (project)
Nyeri	14	17	31
Kirinyaga	1	18	19
Embu	0	17	17
Mbeere	0	20	20
Tharaka Nithi	4	9	13
Meru	40	79	119
Nyambene	2	29	31
Total	61	189	250

Table 6.6-4 Agricultural Land Potential in the Study Area

District	Total Area ('000ha)	High Potential 1) ('000ha)	Medium Potential 2) ('000ha)	Low Potential 3) ('000ha)	Total Potential ('000ha)	All Other Land ('000ha)
Nyeri	329	160	-	12	172	157
Kirinyaga	143	98	10	-	108	35
Embu	271	66	186	-	252	19
Mbeere	(271)	-	-	-	0	-
Tharaka Nithi	(992)	-	-	-	0	-
Meru	992	241	95	315	651	341
Nyambene	(992)	-	-	-	0	-
Total	1,735	565	291	327	1,183	552
(%)	100	33	17	19	68	32

Source: Statistical Abstract, 1995

1) High potential: annual rainfall of 858 mm or more

2) Medium potential: annual rainfall of 735-858 mm in Central Province, 613- 858 mm in Eastern Province

3) Low potential: annual rainfall of 613 mm or less

6.7 Assessment of Irrigation Potential

6.7.1 Available Water Resources for Irrigation

Available water resources for irrigation in the Study Area is assessed according to criteria adopted in Irrigation and Drainage Branch (IDB), MOALD. Namely, available water for irrigation is defined as 70 percent of monthly low discharge which has a probability of 80 percent exceeding. The 30 percent of probability discharge is preserved for other water uses such as domestic, industrial and fishery water and river maintenance.

Available water resources for irrigation are estimated by sub-basin which is divided in 25. The probability discharge of monthly low discharge by sub-basin is assessed by utilizing the result of the National Water Master Plan in 1992 by JICA. The procedure for estimation is as follow:

- (1) Select flow duration curve on a monthly mean basis for the relevant drainage area
- (2) Obtain the discharge factor (0.45) on an ordinate axis corresponding to 80 percent exceedance from the duration curve
- (3) Obtain mean annual discharge (Q_{mean}) from the attached table into river system shown in Figure 6.7-2
- (4) Obtain 80 percent exceedance flow on monthly mean basis (Q_{80mean}) by multiplying (Q_{mean}) and discharge factor, and
- (5) Obtain 80 percent exceedance flow in monthly low basis (Q_{80low}) by multiplying (Q_{80mean}) and conversion factor (0.55) which is estimated by the ratio of annual minimum flow to annual mean flow at 31 regular gauging stations (RGS) (see Table 6.7-1)

The 70 percent of obtained probability discharge can be used for irrigation.

6.7.2 Irrigation Requirement

To calculate the maximum diversion irrigation requirement (MDIR) for crops at intake facility, the following assumptions are made:

- There is no rainfall for a prolonged period of time,
- The amount of soil water is negligible,
- The crop is at peak growth,
- The irrigation efficiency is 60 percent.

$$\text{MDIR} = C_f * E_{To}/IE = 1.1 * 140/0.6 = 255 \text{ mm/month} = 8.5 \text{ mm/day} = 1 \text{ liter/sec/ha}$$

E_{To} : potential evapo-transpiration of a crop (140 mm/month)

C_f : maximum crop factor during growing stage for horticulture crops (1.1)

IE : irrigation efficiency (average;0.6)

The maximum diversion irrigation requirement (MDIR) at intake facility is estimated at one liter/sec/ha.

6.7.3 Irrigation Potential

Since over development on water resources will bring bad impact to existing water use projects and environment of watershed, the irrigation potential shall be allocated properly in sub-basin wide for the execution of irrigation development.

Estimation of irrigation potential for each sub-basin is derived through previously obtained available water resources for irrigation and irrigation water requirement with consideration of following conditions:

- Irrigation potential is allocated in proportion to the presently irrigated and proposed area.
- Existing irrigation projects are given priority on the allocation of irrigation potential.
- In case of that irrigation potential in a sub-basin is bigger than the irrigation area of existing and proposed projects, the surplus water in sub-basin are preserved for future water supply within the sub-basin.
- If a sub-basin belongs to plural districts, irrigation potential is allocated in proportion to the drainage area of related districts.
- Return flows of wasted irrigation are disregarded.
- No storage facilities are considered.
- Proposed irrigation area seem to be land worth irrigation.
- Mwea irrigation scheme managed by NIB, belongs to 4DA sub-basin, is considered in water allocation.
- The irrigation schemes by individual irrigator and river basin development authority are not considered in water allocation because of lack of detail data such as the location and irrigation area.

Estimated total irrigation potential count to 15,700 ha in total. However, as the potential (1,100 ha) for Mwea irrigation project operated by NIB is subtracted from the total potential, the potential for SIS is 14,600 ha as shown below ;

Estimation of Total Irrigation Potential for Study Area

	SIS	Individual	NIB(Mwea)	RDB	Total
Irr. Area (ha)	63,982	2,010	5,800	710	72,502
Irr. Potential (ha)	14,619	-	1,085	-	15,704

In the 25 sub-basins, there exist nine sub-basins where the total irrigation areas of existing and proposed projects are not exceeded the estimated irrigation potential, and the surplus irrigation potentials are 3,300 ha in total (see Table 6.7-2). It is presumed that the surplus irrigation potentials are preserved for future irrigation development. Thus, the remaining irrigation potential of 11,200 ha, as shown below, become an area to be subjected in this study. The SIS irrigation potential is equivalent to 18 percent of the total proposed irrigation area of 64,000 ha, and the remaining area of 82 percent can not be irrigated.

Irrigation Potential for SIS

	Irrigation Potential with Irrigation Scheme			Irrigation Potential Without Irrigation Scheme	Total Irrigation Potential
	Irrigated Area (ha)	Unirrigated Area (ha)	Sub-Total (ha)		
Dist. Profile (1997)	6,919	31,133	63,982	-	-
Irrig. Potential	4,741	6,480	11,221	3,398	14,619
Ratio (%)	-	-	78	22	100

The estimated irrigable area by district is shown below, and irrigable area by district and sub-basin is shown in Table 6.7-3. The irrigable areas in Meru and Nyeri districts are relatively large, but those of Embu, Tharaka Nithi and Nyambene districts are small.

Estimation of Irrigable Area by District

	Up-date Survey(1997)	JICA M/P Study	
	Nos of Scheme (nos)	Planned Area (ha)	Planned Area (ha)
Nyeri	70	9,142	2,755
Kirinyaga	34	4,249	1,455
Embu	48	908	837
Mbeere	29	2,669	1,792
Tharaka Nithi	48	6,804	1,149
Meru	196	35,695	3,050
Nyambene	38	4,515	445
Total	463	63,982	11,483

The irrigable area by implementation status of SIS is shown in Table 6.7-4. The ratios of irrigable area to proposed irrigation area in fully irrigated scheme, partially irrigated schemes and unirrigated schemes are 95, 20 and 12 percents respectively. This fact implies the irrigation expansion in future has difficulty.

The detail of irrigation potential by sub-basin and district are shown in Annex L.

Table 6.7-1

Ratio of Monthly Mean and Minimum Discharge

(1) DA-4 Basin

RGS	Record Period	Item	Monthly Discharge (cu.m/sec)												Mean	Ratio = Mean/Mini.
			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
4AA01	1970-92	Mean	0.33	0.31	0.41	1.40	1.46	0.66	0.38	0.37	0.37	0.61	0.70	0.41	0.62	0.33
4AA01		Mini.	0.13	0.14	0.15	0.25	0.38	0.30	0.20	0.17	0.15	0.16	0.19	0.19	0.20	
4AB05	1970-96	Mean	1.34	1.01	0.99	2.75	2.95	1.28	1.01	1.30	1.24	1.74	2.79	1.74	1.68	0.44
4AB05		Mini.	0.58	0.49	0.45	0.85	1.07	0.70	0.58	0.65	0.62	0.75	1.19	0.83	0.73	
4AC03	1970-96	Mean	5.58	4.53	4.94	14.88	18.25	8.32	5.45	5.42	5.50	8.49	13.33	8.31	8.58	0.51
4AC03		Mini.	3.19	2.82	2.85	4.52	7.57	5.12	4.12	3.78	3.36	3.95	5.99	4.77	4.34	
4AC04	1970-88	Mean	2.10	1.92	1.98	6.15	9.01	4.37	3.08	3.39	2.68	3.87	5.57	3.46	3.97	0.52
4AC04		Mini.	1.38	1.27	1.17	2.23	4.18	2.76	1.89	1.90	1.75	1.73	2.67	2.00	2.08	
4AD01	1970-96	Mean	7.76	5.77	6.55	17.82	27.94	15.37	9.77	7.74	6.83	10.10	17.95	12.58	12.18	0.64
4AD01		Mini.	5.55	4.37	4.01	7.78	16.33	10.80	7.72	6.47	5.32	5.67	11.12	8.46	7.80	
4BC04	1970-94	Mean	1.19	0.96	1.26	3.12	6.90	5.32	2.35	1.82	1.30	1.34	2.38	1.74	2.47	0.54
4BC04		Mini.	0.80	0.66	0.82	0.97	2.81	2.72	1.68	1.29	0.89	0.77	1.42	1.24	1.34	
4DA02	1970-95	Mean	1.21	0.98	0.94	1.73	3.82	2.93	1.90	1.50	1.23	1.32	2.27	1.65	1.79	0.65
4DA02		Mini.	1.01	0.80	0.79	0.85	1.41	1.86	1.48	1.24	1.03	0.93	1.43	1.21	1.17	
4DA10	1970-96	Mean	6.27	4.90	4.49	9.85	26.85	17.42	10.46	8.84	7.61	8.36	12.23	8.82	10.51	0.65
4DA10		Mini.	4.74	3.94	3.42	4.02	12.67	11.19	8.15	6.78	6.08	5.54	8.48	6.89	6.82	
4DC02	1976-96	Mean	7.47	5.82	6.79	12.35	19.83	14.95	9.91	7.39	6.92	11.69	13.43	11.43	10.67	0.68
4DC02		Mini.	5.45	3.83	3.68	6.55	13.16	11.27	7.50	5.57	5.03	7.41	8.84	8.15	7.20	
4DC03	1970-96	Mean	2.78	1.86	1.66	3.89	8.16	5.39	3.77	3.28	3.19	4.31	5.92	3.88	4.01	0.66
4DC03		Mini.	2.06	1.35	1.05	1.56	4.29	4.06	3.06	2.64	2.51	2.28	4.12	2.78	2.65	
4DD02	1970-93	Mean	13.42	9.00	10.98	25.60	41.99	28.60	17.45	21.29	17.74	22.83	27.66	19.08	21.30	0.59
4DD02		Mini.	9.85	6.01	5.53	7.35	19.98	19.63	14.23	16.24	10.40	12.41	15.01	13.71	12.53	
4EA06	1970-95	Mean	9.36	7.37	7.99	20.39	20.84	10.03	6.67	5.27	8.68	8.39	21.87	14.07	11.74	0.59
4EA06		Mini.	6.72	5.40	5.04	8.89	10.42	7.61	5.68	4.66	5.39	4.45	9.49	8.69	6.87	
4EA07	1970-95	Mean	28.20	18.46	18.13	52.07	55.42	29.74	18.18	12.54	9.65	23.03	58.78	43.74	30.66	0.56
4EA07		Mini.	18.65	12.83	9.31	17.85	34.69	21.03	13.24	10.19	7.00	7.90	26.70	27.43	17.24	
4EB01	1970-96	Mean	2.01	1.55	4.44	4.99	6.39	2.89	1.83	1.46	1.33	3.91	6.70	3.98	3.46	0.50
4EB01		Mini.	1.48	1.20	1.00	1.76	2.87	1.94	1.52	1.28	1.00	1.28	3.22	2.32	1.74	
4EB04	1978-96	Mean	1.90	1.34	1.35	3.82	8.61	4.06	2.28	1.98	1.67	3.12	6.16	3.34	3.30	0.58
4EB04		Mini.	1.42	1.02	0.76	1.34	3.94	2.60	1.84	1.58	1.33	1.39	3.62	2.30	1.93	
4EB05	1970-96	Mean	2.13	1.72	1.81	5.02	39.03	4.35	2.61	2.20	1.86	5.01	9.05	3.75	6.55	0.34
4EB05		Mini.	1.54	1.27	1.09	1.64	5.43	2.57	2.01	1.74	1.40	1.61	4.04	2.31	2.22	
4EB09	1970-96	Mean	1.00	0.67	0.55	1.93	4.19	1.51	0.62	0.43	0.33	0.94	3.05	1.60	1.40	0.49
4EB09		Mini.	0.64	0.45	0.28	0.63	1.87	0.95	0.41	0.33	0.21	0.35	1.08	1.01	0.68	
4EB11	1970-88	Mean	1.53	1.18	1.56	13.23	16.63	4.81	1.04	0.01	0.00	3.13	16.34	7.24	5.56	0.30
4EB11		Mini.	0.19	0.69	0.05	1.95	9.05	1.15	0.02	0.00	0.00	0.00	4.19	2.61	1.66	
4F04	1970-95	Mean	1.86	1.70	1.62	2.14	2.31	1.86	1.51	1.35	1.36	1.46	1.95	2.08	1.77	0.82
4F04		Mini.	1.64	1.47	1.39	1.51	1.83	1.57	1.35	1.16	1.23	1.14	1.43	1.74	1.45	
4F05	1970-96	Mean	2.14	1.26	1.14	1.96	2.50	1.47	1.12	0.94	0.75	1.22	2.59	3.15	1.69	0.65
4F05		Mini.	1.46	0.99	0.74	1.10	1.54	1.14	0.96	0.79	0.59	0.62	1.34	1.80	1.09	
4F10	1970-96	Mean	10.81	7.51	7.31	19.26	16.35	8.52	5.84	4.62	3.89	7.91	19.24	17.88	10.76	0.58
4F10		Mini.	7.64	6.16	4.80	7.00	9.63	6.70	4.99	3.93	3.34	3.04	6.85	10.79	6.24	
4F13	1970-96	Mean	142.34	119.47	147.33	304.53	324.90	184.96	136.42	119.35	115.70	160.06	251.41	167.52	181.17	0.58
4F13		Mini.	90.04	86.42	90.29	122.82	169.34	122.83	95.52	84.98	74.46	85.00	131.25	114.23	105.60	
4F17	1970-96	Mean	3.96	2.61	2.39	8.69	7.50	2.81	1.77	1.27	1.37	3.56	11.10	7.09	4.51	0.43
4F17		Mini.	2.37	1.92	1.38	2.00	3.23	2.09	1.36	1.04	0.77	0.83	2.77	3.70	1.96	
4F19	1970-95	Mean	17.63	13.46	16.54	29.14	23.54	16.59	9.81	9.17	6.57	12.81	23.44	21.15	16.25	0.66
4F19		Mini.	13.87	11.29	10.10	12.87	15.93	14.08	8.48	8.02	5.61	6.04	11.08	12.59	10.67	
Average																0.55

(2) DA-5 Basin

RDS	Record Period	Item	Monthly Discharge (cu.m/sec)												Mean	Ratio = Mean/Mini.
			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
4AB05	1980-94	Mean	3.19	2.74	2.05	2.58	2.68	2.62	2.10	2.50	2.16	2.29	3.22	3.46	2.63	0.78
4AB05		Mini.	1.66	1.94	1.75	1.66	2.23	2.29	1.93	2.28	2.04	2.03	2.34	2.38	2.04	
4AC03	1970-94	Mean	0.99	0.97	0.77	1.86	1.42	0.73	0.61	0.73	0.59	0.70	1.37	1.46	1.02	0.46
4AC03		Mini.	0.46	0.43	0.36	0.59	0.59	0.43	0.37	0.38	0.33	0.40	0.63	0.60	0.46	
0.00	1970-94	Mean	0.49	0.31	0.36	0.97	1.36	0.83	0.53	0.49	0.52	0.75	1.27	0.69	0.71	0.50
4AC04		Mini.	0.25	0.19	0.17	0.38	0.61	0.41	0.33	0.27	0.26	0.30	0.67	0.40	0.35	
4AD01	1970-94	Mean	10.05	17.83	1.07	19.64	0.98	0.99	0.84	2.24	1.02	0.83	2.62	14.66	6.06	(0.09)
4AD01		Mini.	0.78	0.55	0.40	0.63	0.48	0.44	0.49	0.55	0.45	0.49	0.67	0.86	0.57	
4AD01	1970-88	Mean	0.16	0.15	0.17	0.20	0.23	0.20	0.21	0.21	0.21	0.20	0.23	0.20	0.20	0.79
4AD01		Mini.	0.14	0.13	0.12	0.13	0.17	0.16	0.17	0.17	0.17	0.17	0.18	0.17	0.16	
4BC04	1970-94	Mean	10.88	8.39	8.22	9.20	9.18	9.45	10.22	10.69	9.98	10.17	9.01	11.16	9.71	0.47
4BC04		Mini.	5.47	5.09	4.61	3.98	4.35	3.89	4.16	4.23	4.47	4.86	4.28	5.30	4.56	
4DA10	1970-86	Mean	6.43	8.39	10.74	32.17	25.30	13.37	14.13	22.49	19.49	19.70	28.48	13.74	17.87	0.37
4DA10		Mini.	2.42	3.80	3.06	5.65	9.20	4.84	5.91	9.29	9.49	7.99	11.22	5.63	6.54	
Average																0.56

Table 6.7-2 Assessment of Irrigation Potential by Sub-basin

Sub-basin	Applied Node Points in Fig. 6.7-2	Occupation ratio of Study Area to Sub-drainage Area (%)	Q _{mean} (m ³ /s)	Q (low, 80) (m ³ /s)	Available Water for Irrigation Q (low, 80)*0.7 (m ³ /s)	Total Irrigation Potential (ha) (5)	Irrigated Area (now)			Allocated Potential for Irrigated Area			Total Irrigation Potential for SIS (ha) (11)=(8)+(10)	Proposed Irr. Area for Expansion (ha) (12)	Allocated Potential for SIS Expansion (ha) (13)=Min(10), (12)	Remaining Irrigation Potential for Future Dev. (ha) (14)=(10)-(13)
							Flow (2)=(1)*0.45 (m ³ /s)	SIS (ha) (6)	NIB (ha) (7)	SIS (ha) (8)=Min(5), (6)	NTB (ha) (9)=(5)-(8)	SIS Expansion (ha) (10)=(5)-(8)				
1.1 Tana River Basin																
4AA	1	100	2.7	1.215	0.668	468	608	-	468	-	-	468	1,901	0	0	
4AB	2	100	3.2	1.000	0.550	385	18	-	367	-	-	385	1,214	367	0	
4AC	4	100	6.0	2.700	1.485	1,040	2	-	1,038	-	-	1,040	74	74	964	
4AD	6	100	6.3	2.835	1.559	1,091	10	-	1,081	-	-	1,091	794	794	287	
4BA	8	100	4.2	1.890	1.040	728	0	-	728	-	-	728	0	0	728	
4BB	10	100	4.0	1.800	0.990	693	215	-	478	-	-	693	1,462	478	0	
4BC	12	100	3.0	1.350	0.743	520	28	-	492	-	-	520	928	492	0	
4BG	20	33	3.2	1.440	0.792	554	51	-	503	-	-	554	239	239	264	
4DA	34+36	100	6.9	3.105	1.708	1,195	590	5,800	0*	1,085	-	1,195	1,220	0	0	
4DB	38	100	4.3	1.935	1.064	745	20	-	725	-	-	745	387	387	338	
4DC	39	100	3.7	1.665	0.916	641	29	-	612	-	-	641	582	582	30	
4DD	41	100	4.3	1.935	1.064	745	62	-	683	-	-	745	1,288	683	0	
4DE	31	10	0.6	0.270	0.149	104	0	-	104	-	-	104	0	0	104	
4EA	57+60	100	5.7	2.565	1.411	988	922	-	66	-	-	988	6,352	66	0	
4EB	58	100	9.3	4.185	2.302	1,611	146	-	1,465	-	-	1,611	2,713	1,465	0	
4EC	55	100	4.6	2.070	1.139	797	51	-	746	-	-	797	568	568	178	
4ED	45+48+51+54	16	3.0	1.350	0.743	520	5	-	515	-	-	520	10	10	505	
4FA	64+66	90	9.5	4.275	2.351	1,818	2,882	-	0	-	-	1,818	25,443	0	0	
4FB	3	65	1.3	0.585	0.322	225	270	-	225	-	-	225	5,900	0	0	
Others	-	-	-	-	-	4	4	-	0	-	-	4	-	-	-	
Sub-total	-	-	-	-	-	14,872	5,913	5,800	4,184	1,085	9,603	13,787	51,075	6,205	3,398	
1.2 Ewaso N'guro River Basin																
5BA	16	10	0.1	0.045	0.025	17	0	-	0	-	-	17	110	17	0	
5BB	17	100	1.5	0.675	0.371	260	85	-	85	-	-	260	1,998	175	0	
5BC	19	25	1.1	0.495	0.272	191	431	-	191	-	-	191	960	0	0	
5BE	23	33	0.9	0.405	0.223	156	342	-	156	-	-	156	1,032	0	0	
5DA	35+37+40	33	1.2	0.540	0.297	208	125	-	83	-	-	208	1,720	83	0	
5ED	-	-	?	0.000	0.000	0	23	-	0	-	-	0	166	0	0	
Sub-total	-	-	-	-	-	832	1,006	0	557	0	275	832	5,986	275	0	
Total	-	-	-	-	-	15,704	6,919	5,800	4,741	1,085	9,878	14,619	57,061	6,480	3,398	

* There exist two kind existing irrigation projects in the 4DA sub-basin, Mwesa irrigation project with a irrigation area of 5,800 ha and smallholder irrigation scheme of 590 ha. The available water is allocated in proportion to the existing irrigation area, namely irrigation potential of 110 ha for SIS and of 1,085 ha for Mwesa irrigation project are allocated. Then the remaining potential for SIS expansion is all in 4DA sub-basin

Table 6.7-3 Allocation of Irrigation Potential by Sub-basin

(1) Allocation of Irrigation Potential for Irrigated Area													
	Nyeni			Embu			Mbere			Tharaka Nihhi			Total
	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)		
1.1 Tana River Basin													
4AA	468											468	
4AB	18											18	
4AC	2											2	
4AD	10											10	
4BA	0											0	
4BB	103	112										215	
4BC	28											28	
4BG							51					51	
4DA		110										110	
4DB		20										20	
4DC		0	26	3								29	
4DD							62					62	
4DE							0					0	
4EA							76	846				922	
4EB							3	113				116	
4EC							27	24				51	
4ED							5					5	
4FA							0	1701	117			1818	
4FB							0					225	
Others							4					4	
Sub-total	605	270	56	175	189	2,547	342	4184				4184	
1.2 Ewaso Nyiro River Basin													
5BA												0	
5BB												85	
5BC												191	
5BE												156	
5DA												125	
5ED												0	
Sub-total	330	0	0	0	0	227	0	557				557	
Total	935	270	56	175	189	2,774	342	4,741				4,741	

(2) Allocation of Irrigation Potential for Unirrigated Area													
	Nyeni			Embu			Mbere			Tharaka Nihhi			Total
	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)		
1.1 Tana River Basin													
4AA	0											0	
4AB	367											367	
4AC	74											74	
4AD	794											794	
4BA	0											0	
4BB	239	239										478	
4BC	492											492	
4BG							239					239	
4DA												0	
4DB		387										387	
4DC		80	440	52								572	
4DD							683					683	
4DE							0					0	
4EA							15	51				66	
4EB							87	308	909	161		1465	
4EC							243	225				468	
4ED							10					10	
4FA							0	0	0	0		0	
4FB							0	0	0	0		0	
Others							0					0	
Sub-total	1,474	1,198	780	1,617	924	212	0	6,205				6,205	
1.2 Ewaso Nyiro River Basin													
5BA	17											17	
5BB	175											175	
5BC	0											0	
5BE												0	
5DA								83				83	
5ED								0				0	
Sub-total	192	0	0	0	0	83	0	275				275	
Total	1,666	1,198	780	1,617	924	295	0	6,480				6,480	

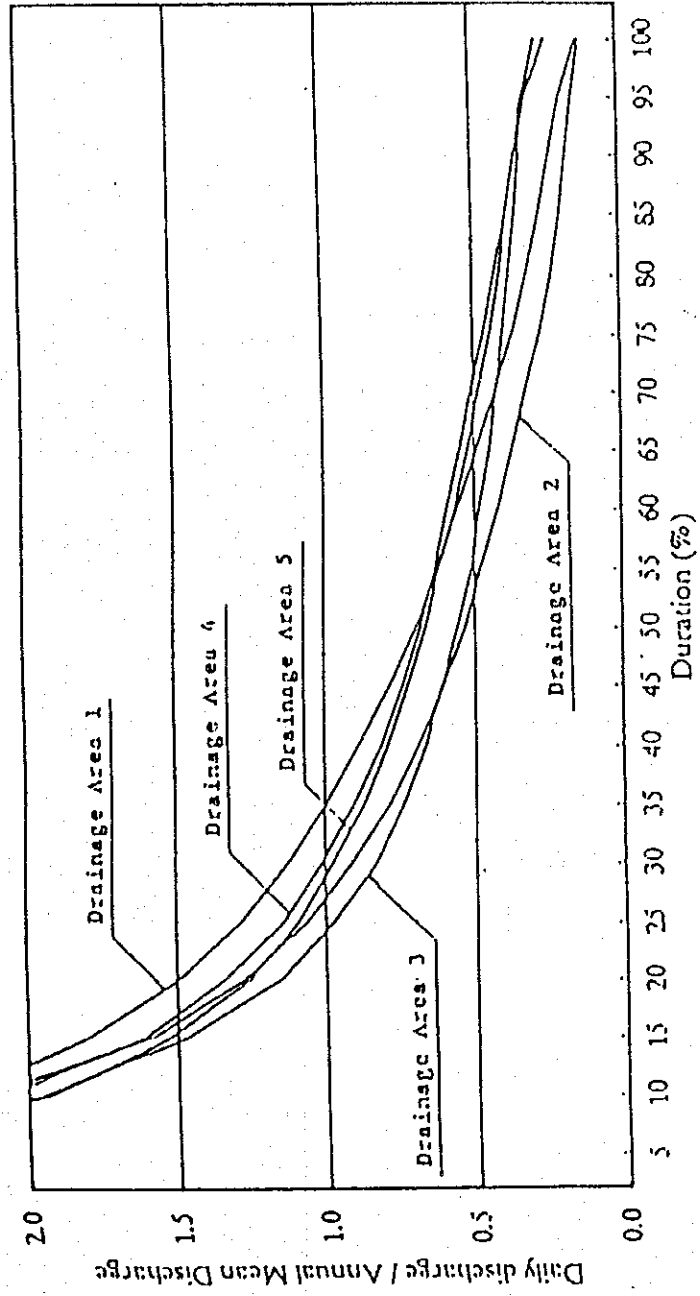
(3) Allocation of Irrigation Potential for Whole Area													
	Nyeni			Embu			Mbere			Tharaka Nihhi			Total
	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)		
1.1 Tana River Basin													
4AA	468											468	
4AB	385											385	
4AC	76											76	
4AD	804											804	
4BA	0											0	
4BB	342	351										693	
4BC	520											520	
4BG							290					290	
4DA		110										110	
4DB		407										407	
4DC		80	476	55								611	
4DD							745					745	
4DE							0					0	
4EA							91	897				988	
4EB							80	338	1022	161		1611	
4EC							270	349				619	
4ED							15					15	
4FA							0	1701	117			1818	
4FB							0					225	
Others							4					4	
Sub-total	2,079	1,468	836	1,792	1,113	2,759	342	10,389				10,389	
1.2 Ewaso Nyiro River Basin													
5BA	17											17	
5BB	260											260	
5BC	191											191	
5BE	54											156	
5DA												208	
5ED												0	
Sub-total	522	0	0	0	0	0	83	210	0	0	0	815	
Total	2,601	1,468	836	1,792	1,113	3,069	342	11,221				11,221	

Table 6.7-4 Irrigable Area for Smallholder Irrigation Scheme by Status

District	Fully Irrigated Scheme			Partially Irrigated Scheme			Unirrigated Scheme			Total Irrigable Area (ha)	Ratio (%)	
	Planned Area (1) (ha)	Area (2) (ha)	Ratio (%)	Planned Area (3) (ha)	Area (4) (ha)	Ratio (%)	Planned Area (5) (ha)	Area (6) (ha)	Ratio (%)			
Nyeri	780	714	92	2,059	487	24	6,303	1,400	22	9,142	2,601	28
Kirinyaga	142	142	100	2,017	710	35	2,090	616	29	4,249	1,468	35
Embu	0	0	-	367	345	94	541	491	91	908	836	92
Mbeere	0	0	-	1,084	1,084	100	1,585	708	45	2,669	1,792	67
Tharaka Nithi	104	104	100	731	718	98	5,969	314	5	6,804	1,136	17
Meru	423	423	100	21,997	2,485	11	13,275	161	1	35,695	3,069	9
Nyambene	0	0	-	3,145	342	11	1,370	0	0	4,515	342	8
Total	1,449	1,383	95	31,400	6,171	20	31,133	3,690	12	63,982	11,244	18

Source) This table is produced based on "key data of irrigation schemes in seven districts (Annex Table L.1-2)" and "allocated irrigation potential by sub-basin (Table 6.7-3)"

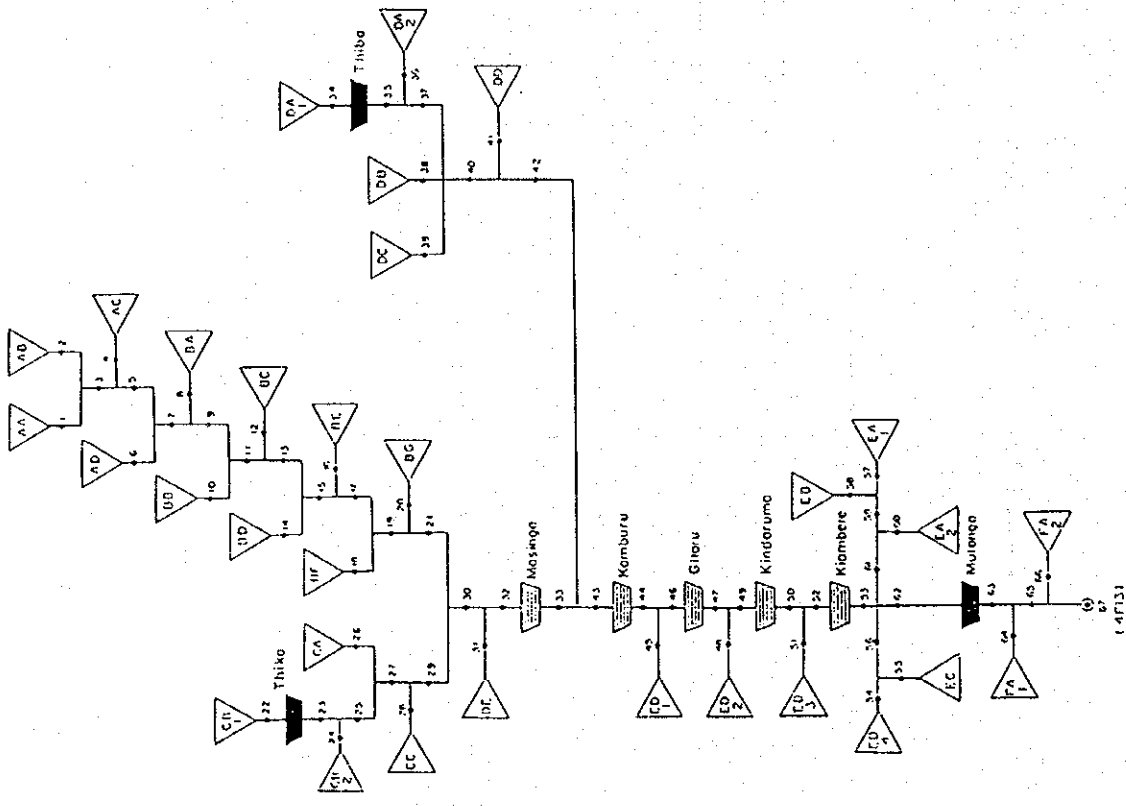
Figure 6.7-1 Flow Duration Curve on the Basis of Mean Monthly River Runoff



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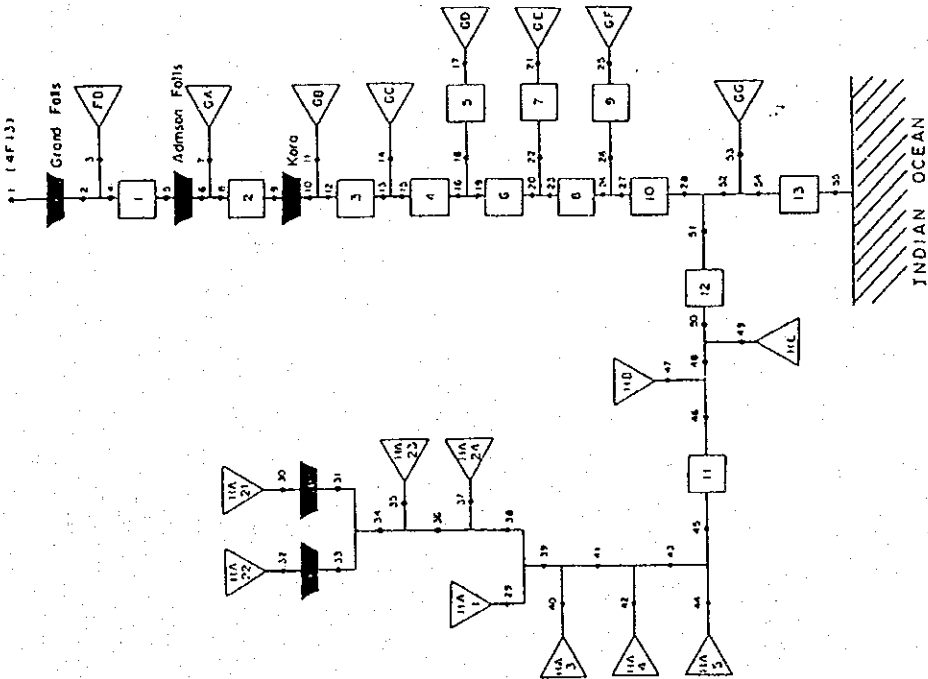
Node	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1	2.0	1.8	2.0	4.5	4.0	2.1	1.6	2.0	1.8	2.7	4.5	2.7	2.7
2	2.2	2.0	2.4	5.9	5.9	2.4	1.8	2.3	1.9	3.2	5.5	3.2	3.2
3	4.2	3.0	4.4	9.9	10.7	4.5	3.4	4.3	3.7	5.9	10.0	5.9	5.9
4	4.2	3.7	3.7	8.1	13.9	7.6	5.1	3.9	3.3	4.6	7.7	5.7	6.0
5	8.5	4.0	4.0	18.2	14.5	12.2	8.7	8.4	3.6	10.7	12.9	11.9	12.0
6	13.1	11.7	12.2	26.8	16.9	14.1	14.1	12.7	10.2	15.6	26.0	18.0	18.4
7	13.4	12.1	14.1	32.0	10.4	21.3	17.1	15.5	11.0	19.2	32.5	22.4	22.6
8	15.5	12.6	17.0	35.3	6.8	23.0	20.9	12.8	11.0	22.2	32.1	23.0	24.6
10	18.0	16.5	17.0	38.1	59.3	30.3	29.9	12.9	13.4	22.5	37.3	26.7	26.0
11	18.7	17.0	18.3	38.1	59.3	30.3	29.9	12.9	13.4	22.5	37.3	26.7	26.0
12	17.7	17.5	18.3	42.3	66.1	34.1	22.8	20.4	17.1	25.0	42.3	29.6	29.7
13	20.3	18.1	18.1	20.7	33.2	19.4	13.7	12.1	11.0	18.2	19.5	15.4	16.1
14	32.6	20.4	30.9	63.2	98.6	53.4	36.7	32.5	28.1	38.2	61.8	44.7	45.8
15	8.0	6.1	8.0	16.5	25.4	15.1	9.6	7.8	6.7	8.9	15.1	10.8	11.9
16	41.0	34.9	39.3	80.1	128.4	69.0	46.7	40.8	35.2	47.6	77.3	55.9	58.1
17	3.8	4.3	3.8	11.3	20.2	10.6	6.0	3.7	4.3	6.4	10.7	7.7	8.4
18	46.7	39.4	43.1	91.6	149.7	79.6	53.5	46.5	40.0	54.0	88.3	63.6	66.5
19	6.4	4.8	6.4	13.2	23.5	12.1	7.7	6.3	5.3	7.1	12.3	8.7	9.5
20	53.1	44.2	51.6	104.8	173.2	91.7	61.2	52.7	45.4	61.1	100.5	72.3	76.0
21	1.5	1.1	1.2	3.7	6.8	3.5	2.1	1.4	1.1	1.3	3.0	2.5	2.4
22	1.5	1.1	1.2	3.7	6.8	3.5	2.1	1.4	1.1	1.3	3.0	2.5	2.4
23	1.5	1.1	1.2	3.7	6.8	3.5	2.1	1.4	1.1	1.3	3.0	2.5	2.4
24	2.5	1.9	2.0	6.3	11.6	6.1	3.6	2.4	1.9	2.2	5.2	4.2	4.1
25	4.5	3.5	3.7	10.5	18.9	9.9	6.1	4.3	3.5	3.9	12.8	7.1	7.1
26	6.9	5.5	5.7	15.3	27.0	14.4	9.1	6.6	5.4	6.0	12.8	10.5	10.4
27	11.4	9.0	9.3	25.8	45.9	24.3	15.3	10.9	8.9	9.9	21.5	17.6	17.5
28	10.7	8.0	8.4	26.7	48.9	25.0	15.0	10.2	7.9	9.0	21.9	17.6	17.5
29	24.5	19.3	20.1	54.8	97.1	51.7	32.6	23.4	19.1	21.2	45.7	37.5	37.3
30	77.6	63.5	71.7	159.6	270.3	143.4	93.7	76.1	64.5	82.4	146.2	109.8	113.2
31	3.8	2.9	3.0	9.5	17.4	8.9	5.3	3.6	2.8	3.2	9.5	6.3	6.2
32	81.9	66.4	74.7	169.4	287.8	152.3	99.1	79.7	67.1	85.6	154.0	116.1	119.6
33	87.9	76.5	86.5	183.4	272.1	150.1	100.7	82.1	71.3	85.6	149.2	110.2	119.6
34	1.0	0.9	0.8	2.1	3.6	2.4	1.6	1.1	1.2	2.0	2.6	1.5	1.8
35	1.0	0.9	0.8	2.1	3.6	2.4	1.6	1.1	1.2	2.0	2.6	1.5	1.8
36	2.3	2.3	2.3	6.1	11.4	7.1	4.6	3.0	2.3	2.7	7.8	4.7	4.7
37	2.3	2.3	2.3	6.1	11.4	7.1	4.6	3.0	2.3	2.7	7.8	4.7	4.7
38	2.2	2.0	1.8	5.2	9.6	6.5	3.9	2.6	2.0	2.1	10.9	6.7	7.2
39	7.7	7.7	7.7	18.1	32.9	20.8	13.4	9.3	8.0	8.1	19.6	13.7	13.7
40	8.9	4.0	6.8	18.1	32.9	20.8	13.4	9.3	8.0	8.1	19.6	13.7	13.7
41	2.4	1.8	1.8	5.1	9.5	5.9	3.3	2.2	2.7	4.8	6.5	3.7	4.1
42	14.0	12.3	11.3	35.9	45.1	29.4	20.3	17.6	15.6	24.5	32.2	19.6	22.3
43	101.9	88.8	97.8	179.3	317.2	179.4	120.9	99.7	87.1	112.0	181.3	137.9	141.9
44	105.9	95.1	103.6	171.3	305.9	177.3	121.3	102.7	92.6	112.0	177.8	138.6	142.1
45	106.5	95.5	104.1	172.7	307.9	178.0	121.7	103.1	92.8	113.4	179.6	139.6	142.9
46	106.5	95.5	104.1	172.7	307.9	178.0	121.7	103.1	92.8	113.4	179.6	139.6	142.9
47	106.7	95.5	104.4	172.5	307.6	177.9	121.6	103.2	92.8	113.3	179.5	139.8	142.9
48	1.2	0.8	1.0	3.0	4.0	1.5	1.5	0.9	0.5	1.2	3.6	2.1	1.7
49	108.0	96.3	105.4	175.4	311.5	179.4	122.4	104.0	93.3	114.6	183.1	141.9	144.6
50	108.0	96.3	105.5	175.3	311.2	179.4	122.4	104.0	93.3	114.6	183.1	141.9	144.6
51	9.2	6.2	7.3	28.0	28.6	11.5	5.7	6.4	3.5	9.2	26.6	15.6	12.7
52	117.4	102.5	112.8	197.2	340.8	190.9	128.1	110.5	96.0	123.7	209.6	157.6	157.3
53	117.7	104.1	114.4	195.2	339.6	190.4	128.1	110.5	96.9	123.6	209.6	157.6	157.3
54	2.0	1.3	1.5	4.7	6.3	2.4	1.2	1.4	1.1	1.6	1.7	1.0	1.8
55	3.3	2.5	2.8	7.0	10.9	4.6	2.8	2.5	2.0	3.7	5.6	3.1	4.6
56	3.3	2.5	2.8	7.0	10.9	4.6	2.8	2.5	2.0	3.7	5.6	3.1	4.6
57	4.0	3.8	4.2	11.4	17.4	7.1	4.0	3.8	2.2	4.1	14.1	8.4	7.5
58	6.7	5.0	5.6	13.9	21.6	9.2	5.6	5.2	4.0	7.5	16.9	10.1	10.3
59	10.6	7.8	8.9	21.1	32.1	14.2	8.6	7.8	6.3	11.6	26.3	15.7	14.2
60	11.3	8.2	9.4	22.5	33.8	15.0	9.0	8.3	6.6	12.2	27.7	16.8	15.0
61	11.3	8.2	9.4	22.5	33.8	15.0	9.0	8.3	6.6	12.2	27.7	16.8	15.0
62	134.3	116.0	128.1	229.4	390.5	212.4	141.1	122.7	106.2	141.3	251.3	182.6	179.7
63	134.3	116.0	128.1	229.4	390.5	212.4	141.1	122.7	106.2	141.3	251.3	182.6	179.7
64	2.8	2.1	2.4	5.4	7.9	3.3	2.0	1.9	1.3	3.1	6.6	4.0	3.3
65	137.4	118.5	130.0	235.0	398.4	216.0	143.4	124.8	107.8	144.9	250.3	186.8	181.3
66	5.6	4.1	4.8	10.6	14.9	6.5	4.0	3.7	2.5	6.2	13.0	8.0	7.0
67	143.4	122.9	136.0	246.1	413.8	222.9	147.8	129.0	110.8	151.5	271.7	195.3	190.9

Figure 6.7-2-1 River System of Upper Tana River Basin



THE STUDY ON THE NATIONAL WATER MASTER PLAN JAPAN INTERNATIONAL COOPERATION AGENCY Upper Tana River Basin

Figure 6.7-2-2 River System of Lower Tana River Basin



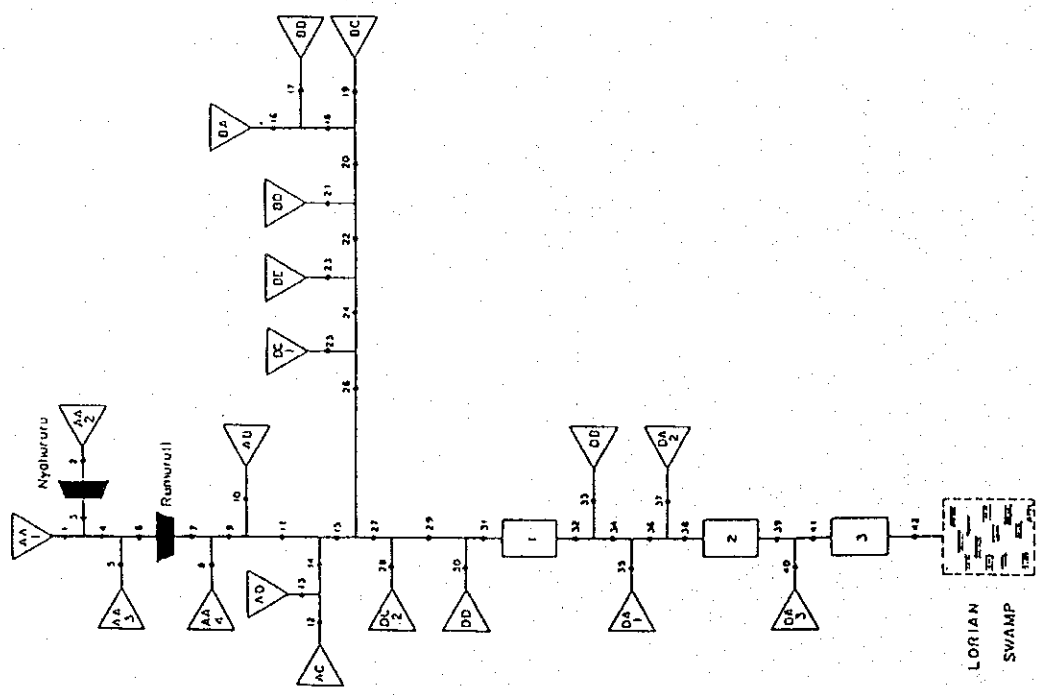
THE STUDY ON THE NATIONAL WATER MASTER PLAN
JAWAH INTERNATIONAL COOPERATION AGENCY

Lower Tana River Basin

Naturalized Mean Monthly Discharge in the Lower Tana River (Unit:cms)

Node	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1	143.4	122.9	136.0	246.1	413.8	222.9	147.8	129.0	110.8	131.5	271.7	195.3	190.9
2	143.4	122.9	136.0	246.1	413.8	222.9	147.8	129.0	110.8	131.5	271.7	195.3	190.9
3	1.7	1.7	2.1	3.4	1.4	1.3	1.3	1.2	1.2	1.1	4.1	3.8	2.0
4	146.4	125.9	139.4	250.8	416.5	235.6	150.4	131.4	113.3	154.1	277.1	200.3	194.3
5	140.1	121.3	133.6	235.5	386.9	212.4	143.7	126.4	109.8	147.1	259.5	189.3	183.8
6	140.1	121.3	133.6	235.5	386.9	212.4	143.7	126.4	109.8	147.1	259.5	189.3	183.8
7	141.7	123.0	135.6	238.9	398.3	213.7	145.0	127.5	110.9	148.4	263.5	193.1	185.8
8	138.5	120.6	132.7	231.2	371.6	207.2	141.6	125.0	109.2	144.9	254.7	187.5	180.6
9	138.5	120.6	132.7	231.2	371.6	207.2	141.6	125.0	109.2	144.9	254.7	187.5	180.6
10	140.3	127.0	135.6	236.0	375.6	208.0	143.4	126.6	110.8	146.7	260.4	192.8	183.4
11	140.3	127.0	135.6	236.0	375.6	208.0	143.4	126.6	110.8	146.7	260.4	192.8	183.4
12	132.0	117.0	128.1	216.5	339.7	192.8	135.0	120.2	106.3	137.8	238.0	178.5	170.2
13	132.0	117.0	128.1	216.5	339.7	192.8	135.0	120.2	106.3	137.8	238.0	178.5	170.2
14	134.8	119.1	130.9	218.4	341.4	194.7	136.9	122.1	108.1	139.7	241.2	181.5	172.4
15	129.4	115.0	125.3	208.6	347.7	182.5	131.3	117.7	105.0	133.9	226.4	172.0	163.7
16	129.4	115.0	125.3	208.6	347.7	182.5	131.3	117.7	105.0	133.9	226.4	172.0	163.7
17	3.2	3.2	3.5	5.7	3.7	3.7	4.1	4.2	4.2	3.9	11.1	4.5	4.1
18	130.9	116.8	127.0	210.2	316.1	165.1	132.4	118.7	106.0	134.9	230.9	176.1	165.7
19	130.9	116.8	127.0	210.2	316.1	165.1	132.4	118.7	106.0	134.9	230.9	176.1	165.7
20	113.9	103.5	112.9	184.3	278.2	162.6	117.1	105.3	94.4	119.4	202.1	154.9	145.9
21	113.9	103.5	112.9	184.3	278.2	162.6	117.1	105.3	94.4	119.4	202.1	154.9	145.9
22	2.4	2.4	3.0	5.3	3.7	3.7	4.1	4.2	4.2	3.9	11.1	4.5	4.1
23	118.3	103.9	115.8	189.7	280.0	164.3	118.8	106.9	95.0	121.1	208.7	161.0	148.9
24	111.4	99.9	109.1	177.8	261.6	154.2	111.9	100.7	90.9	114.0	195.4	151.1	139.8
25	6.6	6.7	8.1	13.5	5.6	5.2	5.1	4.8	4.8	4.7	12.0	7.7	7.6
26	2.8	2.8	3.6	6.5	2.3	2.1	2.0	1.8	1.8	1.9	4.9	3.3	3.6
27	114.2	102.8	112.7	184.3	263.9	156.2	113.9	102.5	92.4	116.0	203.3	158.3	143.4
28	102.7	92.7	101.4	164.0	233.6	139.4	102.4	92.4	83.6	104.2	180.6	141.3	128.2
29	102.7	92.7	101.4	164.0	233.6	139.4	102.4	92.4	83.6	104.2	180.6	141.3	128.2
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	1.2	1.2	1.4	2.2	1.4	1.2	1.2	1.1	1.1	1.1	3.5	1.4	1.2
37	1.2	1.2	1.4	2.2	1.4	1.2	1.2	1.1	1.1	1.1	3.5	1.4	1.2
38	1.2	1.2	1.4	2.2	1.4	1.2	1.2	1.1	1.1	1.1	3.5	1.4	1.2
39	1.2	1.2	1.4	2.2	1.4	1.2	1.2	1.1	1.1	1.1	3.5	1.4	1.2
40	1.0	1.0	1.2	2.0	1.5	1.3	1.3	1.2	1.2	1.2	3.8	1.4	1.3
41	1.0	1.0	1.2	2.0	1.5	1.3	1.3	1.2	1.2	1.2	3.8	1.4	1.3
42	1.3	1.3	1.6	2.6	1.1	1.0	1.0	0.9	0.9	0.9	3.0	2.6	2.6
43	1.3	1.3	1.6	2.6	1.1	1.0	1.0	0.9	0.9	0.9	3.0	2.6	2.6
44	1.1	1.1	1.4	2.3	2.0	1.9	1.9	1.7	1.7	1.7	4.9	2.7	2.7
45	1.1	1.1	1.4	2.3	2.0	1.9	1.9	1.7	1.7	1.7	4.9	2.7	2.7
46	1.3	1.3	1.6	2.6	1.1	1.0	1.0	0.9	0.9	0.9	3.0	2.6	2.6
47	1.3	1.3	1.6	2.6	1.1	1.0	1.0	0.9	0.9	0.9	3.0	2.6	2.6
48	5.1	5.2	6.4	10.9	4.3	4.0	3.8	3.5	3.5	3.5	13.0	12.1	9.2
49	2.8	2.8	3.5	5.8	2.4	2.2	2.0	2.0	2.0	2.0	6.8	4.4	4.4
50	8.0	8.0	9.8	16.6	6.7	6.2	6.0	5.4	5.5	5.0	19.9	18.4	9.7
51	3.8	3.8	4.9	8.7	3.1	2.8	2.7	2.4	2.4	2.4	10.6	9.8	4.8
52	106.5	96.5	106.3	172.7	236.7	142.2	105.1	94.8	86.0	107.0	191.1	151.0	133.0
53	106.5	96.5	106.3	172.7	236.7	142.2	105.1	94.8	86.0	107.0	191.1	151.0	133.0
54	109.6	98.6	110.0	178.9	239.2	144.6	107.5	96.9	88.1	109.3	198.5	157.9	136.7
55	95.3	86.9	95.6	153.3	203.7	124.6	93.5	84.7	77.3	95.0	169.7	135.7	117.9

Figure 6.7-2.3 River System of Ewaso Ng'iro River Basin



Naturalized Mean Monthly Discharge
in the Ewaso Ng'iro (North) River

(Unit:cms)

Node	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1	1.1	1.1	0.0	1.1	1.1	1.1	2.2	3.3	2.2	1.1	1.1	1.1	1.1
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0
4	1.1	1.1	1.1	2.2	2.2	2.2	3.3	3.3	3.3	3.3	3.3	3.3	3.3
5	3.3	3.3	3.3	5.5	5.5	5.5	6.6	6.6	6.6	6.6	6.6	6.6	6.6
6	5.5	5.5	5.5	7.7	7.7	7.7	8.8	8.8	8.8	8.8	8.8	8.8	8.8
7	5.5	5.5	5.5	7.7	7.7	7.7	8.8	8.8	8.8	8.8	8.8	8.8	8.8
8	4.4	4.4	4.4	6.6	6.6	6.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7
9	9.9	9.9	9.9	13.3	13.3	13.3	16.6	16.6	16.6	16.6	16.6	16.6	16.6
10	4.4	4.4	4.4	6.6	6.6	6.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7
11	1.3	1.3	1.3	1.9	1.9	1.9	2.2	2.2	2.2	2.2	2.2	2.2	2.2
12	7.7	7.7	7.7	11.1	11.1	11.1	14.4	14.4	14.4	14.4	14.4	14.4	14.4
13	4.4	4.4	4.4	6.6	6.6	6.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7
14	1.1	1.1	1.1	1.7	1.7	1.7	2.1	2.1	2.1	2.1	2.1	2.1	2.1
15	2.4	2.4	2.4	3.6	3.6	3.6	4.3	4.3	4.3	4.3	4.3	4.3	4.3
16	8.8	8.8	8.8	13.3	13.3	13.3	16.6	16.6	16.6	16.6	16.6	16.6	16.6
17	1.5	1.5	1.5	2.3	2.3	2.3	3.1	3.1	3.1	3.1	3.1	3.1	3.1
18	2.3	2.3	2.3	3.6	3.6	3.6	4.8	4.8	4.8	4.8	4.8	4.8	4.8
19	4.4	4.4	4.4	6.6	6.6	6.6	8.8	8.8	8.8	8.8	8.8	8.8	8.8
20	7.0	7.0	7.0	11.1	11.1	11.1	14.4	14.4	14.4	14.4	14.4	14.4	14.4
21	7.7	7.7	7.7	11.1	11.1	11.1	14.4	14.4	14.4	14.4	14.4	14.4	14.4
22	7.7	7.7	7.7	11.1	11.1	11.1	14.4	14.4	14.4	14.4	14.4	14.4	14.4
23	1.5	1.5	1.5	2.3	2.3	2.3	3.1	3.1	3.1	3.1	3.1	3.1	3.1
24	9.2	9.2	9.2	13.3	13.3	13.3	17.7	17.7	17.7	17.7	17.7	17.7	17.7
25	4.4	4.4	4.4	6.6	6.6	6.6	8.8	8.8	8.8	8.8	8.8	8.8	8.8
26	9.7	9.7	9.7	14.4	14.4	14.4	19.1	19.1	19.1	19.1	19.1	19.1	19.1
27	12.1	12.1	12.1	18.2	18.2	18.2	24.3	24.3	24.3	24.3	24.3	24.3	24.3
28	9.9	9.9	9.9	14.8	14.8	14.8	19.7	19.7	19.7	19.7	19.7	19.7	19.7
29	13.0	13.0	13.0	19.5	19.5	19.5	26.0	26.0	26.0	26.0	26.0	26.0	26.0
30	1.9	1.9	1.9	2.9	2.9	2.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
31	15.1	15.1	15.1	22.6	22.6	22.6	30.1	30.1	30.1	30.1	30.1	30.1	30.1
32	13.3	13.3	13.3	20.0	20.0	20.0	26.7	26.7	26.7	26.7	26.7	26.7	26.7
33	1.1	1.1	1.1	1.7	1.7	1.7	2.3	2.3	2.3	2.3	2.3	2.3	2.3
34	14.4	14.4	14.4	21.6	21.6	21.6	28.8	28.8	28.8	28.8	28.8	28.8	28.8
35	8.8	8.8	8.8	13.2	13.2	13.2	17.6	17.6	17.6	17.6	17.6	17.6	17.6
36	15.3	15.3	15.3	22.9	22.9	22.9	30.5	30.5	30.5	30.5	30.5	30.5	30.5
37	4.4	4.4	4.4	6.6	6.6	6.6	8.8	8.8	8.8	8.8	8.8	8.8	8.8
38	15.7	15.7	15.7	23.6	23.6	23.6	31.5	31.5	31.5	31.5	31.5	31.5	31.5
39	14.4	14.4	14.4	21.6	21.6	21.6	28.8	28.8	28.8	28.8	28.8	28.8	28.8
40	6.6	6.6	6.6	10.0	10.0	10.0	13.3	13.3	13.3	13.3	13.3	13.3	13.3
41	15.0	15.0	15.0	22.5	22.5	22.5	30.0	30.0	30.0	30.0	30.0	30.0	30.0
42	6.9	6.9	6.9	10.4	10.4	10.4	13.9	13.9	13.9	13.9	13.9	13.9	13.9

LORIAN SWAMP

THE STUDY ON
THE NATIONAL WATER MASTER PLAN
JAPAN INTERNATIONAL COOPERATION AGENCY

Ewaso Ng'iro (north) River Basin

6.8 Assessment of Farmers' Organization

6.8.1 Assessment Framework

Performance of any organization can only be assessed by examining the extent to which it has succeeded in achieving the objectives for which it was established. In an irrigation scheme, the objectives of a farmers' organization can be perceived at two levels:

Primary objectives

- Installation of common irrigation works (water intake, conveyance and distribution network)
- Reliable and fair irrigation water supply to members
- Effective maintenance of common main irrigation works

Secondary Objectives

- Procurement and re-payment of community-based loans
- Acquisition of remunerative market outlets for irrigated produce
- Setting and collection of irrigation maintenance charges
- Development of a realistic contingency maintenance fund in a bank account
- Minimization of water use conflicts
- Management of external relations with the outside world (Government agencies, NGOs, input suppliers, produce buyers, credit providers)
- Institutional stability with internal mechanisms for resolving organizational conflicts as well as for effecting leadership changes

The above framework permits performance assessment of existing irrigation farmers' organization. It may be pointed out that the primary and secondary objective levels are closely related. Indeed failure to attain one objective can rule out or reduce success in another objective. For instance, failure to secure stable and profitable produce markets can lead to inability to collect maintenance fees which, in turn, will imply poor system maintenance.

On the basis of socio-economic and PRA surveys, the performance of irrigation farmers' organizations was assessed against their respective score (good, modest or poor) in achieving primary and secondary objectives. The results of the performance assessment appears rather disappointing, as shown below;

Performance Assessment of Irrigation schemes in the Seven survey Sites

Irrigation Scheme	Installation of Irrigation System	Reliable & Fair Water Supply	Irrigation System Maintenance	Water Conflict Management	Marketing Arrangement	Input Loan Repayment	Water Fee Collection
Island Farm	Good	Good, but water limited	Good	Good	Poor	Very Good	Good
Kibirigwi	Poor	Modest	Poor	Modest	Poor	Modest	Poor
Rupingazi	Very Poor	Very poor	very poor	Very Poor	Poor	Poor	Very Poor
Mashamba	No Irrigation Infrastructure	Not applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Ruungu	Infrastructure in-complete	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Nkui	Poor	Poor	Poor	Poor	Poor	Not Applicable	Poor
Kionimba	Modest	Modest	Modest	Good	Good for Tobacco only	Good	Good

Source; JICA Study Team, November 1997

Out of the seven farmers organizations, only Island Farm appears to have done well. With only limited technical support from the staff of MLRRWD, the Water Association has installed an irrigation infrastructure consisting of several intakes and supply canals as well as field feeder pipes and in-field sprinklers. The association has established a viable institutional arrangement for operating and maintaining the common supply system while. At the local trading centre, there is already a capacity ("Jua Kali" artisans) for fabricating and repairing the in-field sprinklers. This demonstrates the organization's capacity to identify and utilize other resources within the community. The farmers' organization can therefore claim to have achieved objectives at the primary level and at the secondary level, with the exception of marketing.

Farmer organizations in the remaining six schemes score poorly on both the primary and secondary objectives. Some of them have not managed to install common irrigation facilities and those which have done so are not maintaining them well or are not managing available water effectively and fairly. And obviously once the primary objectives are not attained, pursuit of secondary objectives becomes difficult or even irrelevant.

6.8.2 Constraints Underlying Poor Performance of Farmers' Organization

Both literature review and field investigations indicate the main constraints underlying the poor performance of farmers organizations to be as follows:

- Inadequate farmers' capacity to organize themselves for collective development of irrigation facilities or joint pursuit of other agricultural objectives common to all the members such as produce marketing (all the schemes except Island Farm)
- Poor leadership resulting in a group that lacks cohesion, common purpose as well as discipline (Rupingazi, Nkui)
- Previous excessive support that stifled farmers initiative to assume responsibility (Kibirigwi, Rupingazi)
- Poor management and organization skills on the part of management committee members
- Lack of financial skills on part of the management committee that have led to misallocation or loss of farmers funds
- Lack of effective social and legal mechanisms for disciplining committee leaders who

misappropriate or misuse the community's resources (Kibirigwi's outstanding court case for 3 years) thus undermining farmers faith in organizations

- Enduring attitude that government/donors are primarily responsible for solving irrigation water and associated agricultural problems such as marketing
- Inadequate extension support on organization, management as well as technical aspects

6.9 Issues and Constraints under the Current System

6.9.1 Issue of Many Uncoordinated Support Agencies

Under the existing situation, agencies that support or promote smallholder irrigation development usually operate independently of one another. Whatever collaboration there is often takes place because of informal understanding among field officers rather than as a result of a formal procedure requirement. In addition, at the national level, the number of agencies directly promoting smallholder irrigation is large and includes:

- Irrigation and Drainage Branch of MOALD
- Water Department of MLRRWD
- Regional authorities under MLRRWD
- Regional Authorities under Ministry of Energy
- Non-Governmental Organizations

All these agencies have different intervention approaches as well as different criteria for selecting target areas and collaborating beneficiary communities. For instance, within the Study Area, IDB, Water Department and Tana & Athi Rivers Development Authorities have, in the past played an active role in planning, designing or otherwise assisting smallholder irrigation development. At the same time, two NGOs (Plan International, Catholic Church) and one Private firm (BAT) have designed smallholder irrigation systems.

Furthermore there are those other agencies whose action or lack of it can affect the performance of smallholder irrigation systems. Such agencies include the Ministry of Public Works and Housing as well as County Councils who are responsible for maintaining access roads; or the Ministry of Culture and Social Services whose official mandate, among others, is community mobilization and community development.

The present lack of a coordinated and coherent approach constrains the performance of smallholder irrigation systems because each agency spreads itself too thinly on the ground. The existence of too many agencies can also confuse farmers since they are not too sure which organization to contact for support services. The issue then is how the agencies that promote or support smallholder irrigation can be coordinated in order to generate a critical mass of effort in advancing smallholder irrigation.

6.9.2 Issue of Harmonizing Technical Design and Community's Capacity

Literature review of documents made available by MOALD underline the importance of farmers' organization in sustaining irrigation activities. The results of the socio-economic and PRA surveys

commissioned as part of this study further support this view.

The issue then is how technical design can be matched with the beneficiary community's social capacity to implement and manage. For a community-based irrigation scheme, the way engineering design and social capacity are harmonized can make all the difference between failure and success.

6.9.3 Credit for Infrastructure and Agricultural Inputs

Within the study area, the present level of individual household savings is low particularly in low-lying marginal Agro-Ecological Zones where rainfall is inadequate and cash crop opportunities are few. The need for an affordable long-term credit for irrigation infrastructure is clearly felt. Furthermore, in the existing irrigation schemes, cash-flow profiles at the household level suggest the need for credit to allow timely procurement of inputs. For example, even in a relatively successful scheme as Island Farm, only a few wealthy farmers or those with outside income sources can afford to grow the more profitable "Gloria" cabbage owing to the high cost of seed. Farmers without sufficient cash then opt for the low-paying ordinary varieties whose net returns are likely to be half those of "Gloria".

Unavailability of credit, hence, constrains both the rate of smallholder irrigation expansion and capacity of irrigating farmers to exploit identified market opportunities.

The issue, then, is how a viable credit mechanism can be put in place as part of a smallholder irrigated horticultural expansion program.

6.9.4 Utilization and Management of Water Resources

In spite of occurrence of two dry seasons annually resulting from the climatological conditions, the proper consolidation of reservoir facilities to SIS development has not been executed in the Study Area. Thus, the available water resources for SIS are limited. Moreover, since definite basin-wide water resources development plans in basin-wide are not prepared by government organization, disorganized irrigation water use and over commitment by irrigation water resources can be observed in many sub-basins.

The actual situation of over commitment can be clearly perceived from the analysis of new expansion potential of irrigation area in Section 6.7. Namely, the estimated total irrigable area of 11,200 ha is only 18 percent of the total proposed area of 64,000 ha. The result of analysis indicates an overcommitment to available water resources.

The expansion potential of the irrigation area by scheme status is shown in Table 6.7-4. The irrigable areas of fully irrigated scheme, partially irrigated scheme and not-irrigated scheme are 70, 21 and 13 percent of planned irrigation area of each category.

The disorganized water use is carried out by some of farmers' groups. Although water intake can be executed after obtaining water permit, actually, some 30 percent of operated SISs has not water permit in any mode. It is said some groups abstract more river water than the discharge permitted in water right.

From the view point of watershed conservation and avoidance of ineffective irrigation investment, the following considerations should be taken into account during planning of irrigation schemes:

- Installation of intake facility with a water control device
- Introduction of canal system which enable to water saving
- Strengthening of farmers organization for O&M works of irrigation facilities and water management

MOALD and MLRRWD should jointly execute the following studies:

- Study for improvement of the precious of irrigation schemes' inventory
- Sub-basin wide study for water resources development
- Study for legal preparation of river water monitoring system

CHAPTER VII.

ASSESSMENT OF HORTICULTURAL PRODUCE MARKETING SYSTEM

CHAPTER VII. ASSESSMENT OF HORTICULTURAL PRODUCE MARKETING SYSTEM

7.1 Distribution and Transaction System Analysis

In the current distribution system of horticultural produce for domestic and foreign markets, it seems difficult to deny the middlemen's roles in moderation of supply and watch for a niche to meet regional demands in volume, price, quality and the areas where crops cannot be cultivated due to seasonal and agro-ecological conditions.

The gender in marketing of horticultural produce is quite obvious. Generally, the middlemen form a team with three to six young men and one driver with three to five-ton loading capacity pick-up trucks. Retailers in markets are mostly, middle-aged women. It seems that men look for immediate cash income and women prefer small but continuous benefits.

From the viewpoints of each stakeholder in horticultural produce marketing, the following constraints are pointed out in the current distribution and transaction systems. Normally, the position of small-scale farmers in transaction are relatively low against middlemen.

Farmers' Level

- Insufficient market information for decision-making in cropping and selling prices and lack of advisory services
- Inaccessibility to markets by high transporting costs using Matatu and lack of know-how in direct or consigning sales in markets
- Lack of advantageous negotiating factors in prices due to poor quality of seeds and seedlings planted and their distribution, lack of storing facilities, undeveloped irrigation system to provide produce during periods of short supply in the country
- Irregular collection by middlemen at certain times and days
- Disorganizing of farmers' groups due to the presence of middlemen resulting from negotiation with individual member farmers
- Risks to cultivate export produce due to difference of demands between domestic and foreign markets
- Low purchasing power

Middlemen's Level

- High transportation costs due to poor road infrastructure which spoil older vehicles and damage produce, cess to enter other districts charged by county councils and accidentally policemen, rapid price escalation of fuel, and expensive purchasing costs of vehicles and spareparts with high customs duty and taxes
- Low quality of produce due to poor grading levels by farmers
- Risks of selling wholesalers and retailers purchased produce from farmers resulting in bargain in evening
- Lack of market information in produce trading volumes for decision-making in the delivery destination (one wholesale and 25 retail markets are operating in Nairobi, but price information is provided only from Wakulima Wholesale Market by newspapers and radio.)
- Lack of farmers' information; place, type of produce, expected harvest volume, harvest period

Wholesalers and Retailers Level

- Poor market infrastructure to maintain quality and price of produce; dusty floors, no roof, poor hygienic facilities and no alternative to storing produce on a long-term basis to adapt to seasonal fluctuation
- Inefficient facilities such as insufficient space and co-existence of wholesalers and retailers even in wholesale markets, which can cause losses in time, price, labor costs
- No utilizing cold storage warehouses for stable supply of perishable produce, though the Study Areas are the center of horticultural produce urban residents in Nairobi and even Mombasa
- High cess to enter the market, which reaches approximately 2.5-3.0 percent of selling price

Exporters' Level

- Difficulty in keeping reliable relationships with farmers for contract farming
- Poor harvesting and grading techniques of farmers
- Poor chemical application and lack of record-keeping by farmers
- Exchange rate of local currency compared with actual economic conditions resulting in loss of market share in EU
- Strict EU market export conditions regarding maximum residue levels (MRLs)
- High collection costs due to poor road infrastructure and taxes on purchase of vehicles
- High costs and limited space of air cargo freight to EU markets
- Limited space and poor facilities for sea freight for mango and avocado for Gulf countries' markets
- Appearance of African competitor countries especially in green beans and peas; Egypt in Dutch market, Senegal in Dutch/French markets, Morocco in French market, Ethiopia in Italian market, Zimbabwe in British market, Cameroon in French market and Gambia in British market

7.2 Marketing Volume and Destination Analysis

The exporting volume by crop, month and destination are recorded by HCDA, but that of domestic marketing is not recorded due to limitation of budget for marketing officers and difficulty to obtain the data from retailers.

7.2.1 Domestic Consumed Produce

The trading volume is roughly estimated at 10,000 ton/year in Karatina Market (Nyeri District), 5,000 ton/year in Nyeri Market (Nyeri), 3,000 ton/year in Kutus Markets (Kirinyaga), 2,000 ton/year in Kagio Market (Kirinyaga), 2,500 ton/year in Embu Market (Embu), 5,000 ton/year in Gakoromone Market (Nyeri). In other markets of Othaya, Mukurueini and Naromoru in Nyeri District, Wanguru, Kerugoya, Baricho and Kagumo in Kirinyaga District, Runenjes, Nembure and Manyatta in Embu District, Siakago, Ishiara and Makutano in Mbeere District, Chuka, Chogoria and Kanwo in Tharaka Nithi District, Nkubu, Mitunguu, Igoji and Timau in Meru District, and Maua, Kangeta and Mikinduri in Nyambene District, 500-1,000 ton/year of produce are traded.

The potato retailers in Chuka market in Tharaka Nithi District, for example, purchase produce of

low quality in taste and freshness from middlemen transporting from Nyahururu in Nyandarua District with over 150km distance, in spite of existence of neighboring major potato production areas in Nyeri and Meru, because of prices. The inhabitants, who stay especially in lowland areas (altitude of 900m-1,200m), located in the semi-arid zone, rarely have opportunities to obtain cash income. In Maua market in Nyambene District, lots of horticultural produce are brought from Meru, because the farmers tend to cultivate profitable miraa herbs and the cash income level is relatively higher. The rural economic conditions might be the main determinant of distribution routes.

Outflows from the Study Areas are to Nairobi, Mombasa, Muranga, Thika, Isiolo, Kisumu and Eldoret, and inflows are from Nyahururu and Nakuru.

7.2.2 Export Produce

1) Cutflowers

The main export produce from Kenya is cutflowers of roses, carnations, statice and alstroemeria, which FOB value accounts at 4.3 billion Ksh or 57 percent of total export of horticultural produce in 1996. The destination are Dutch market (70% of total exports from Kenya) for roses, British Market (48%) for carnations and Dutch market for other cutflowers (75%). Kenya took over the top position from Israel in EU markets, the market share are 24 percent for roses, 59 percent for carnations and 55 percent for other flowers. The production of roses and carnations are dependent on large-scale farms operated by exporters in Naivasha, Athi and Limuru, while statice, alstroemeria and minor flowers are produced by small-scale farmers mainly in South Kinangop in Nyandarua District neighboring the Study Areas. Also in Study Areas, the production of eryngium and roses has begun in Kieni East Division in Nyeri District and Timau Division in Nyeri District. JETRO-Kenya is promoting export of roses and carnations directly to Japan, not through the Dutch market, but main constraints are lack of fumigation facilities in Kenya and limited cargo space.

2) Vegetables

Export of fresh vegetables accounted for 2.6 billion Ksh or 33 percent of total exports of horticultural produce in 1996. Green beans including French beans, snow pea, bobby bean, runner beans and snap pea are exported to EU. The share of Kenyan green beans in EU markets accounts for 30 percent, destined to UK (56%), France (26%) and Belgium, (7%). The peak period occurs in June and December. In the last five years, the Egyptian exports of green beans are rapidly growing in Dutch and British markets. The peak season is duplicated, November to January.

For other vegetables such as okra, chili and Asian vegetables, there are stable demands in the ethnic markets of EU countries, Saudi Arabia, UAE, Seychelles, Djibouti, Bahrain, Kuwait, Lebanon, French Reunion and others. Some seeds of potato are exported to Tanzania and Uganda. Expansive export produce would be okra, ravaya, valore, curry leave, baby corn, parsley, Brussels sprout, chora and ginger. In Saudi Arabia, the market size for fresh beans/peas is limited (5.6 million SR in 1995) compared with frozen beans/peas (13.8 million SR). The strong competitors for this market are Syria and Egypt, but there is still a marketing chance for Kenya due to different harvesting season.

3) Fruits

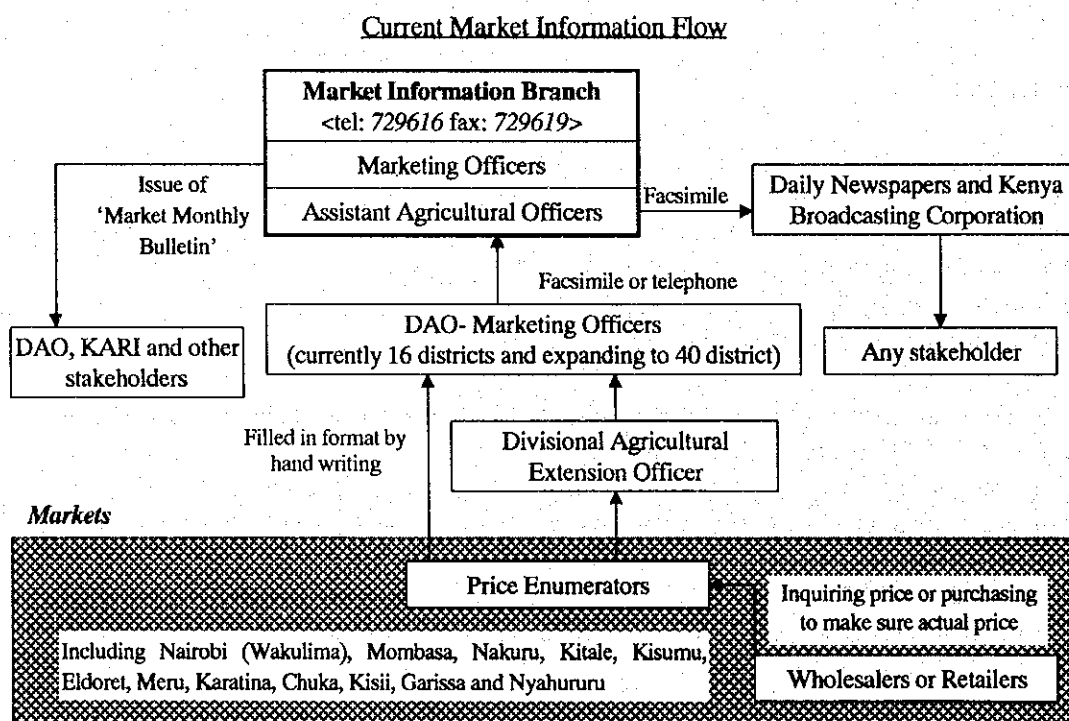
Fruits export accounted for 0.8 billion Ksh or 10 percent of total exports of horticultural produce in 1996. Kenya is the fourth largest exporting country for avocado in EU markets following Israel, Mexico and South Africa. Other destination is the French market (54% of avocado export from Kenya) and Dutch market (33%). Mango is a second fruit produce, mainly exporting to Saudi Arabia (1.49 million SR in CIF) through UAE by sea freight. But Kenya to Saudi Arabia is the fourth ranked following India (15.0 million SR), Sudan (10.9 million SR) and Pakistan(10.4 million SR). Passion fruit is third, exporting to Holland and UK. Notable produce is macadamia nuts, (fourth) exported to Germany. The efforts of the JICA project for the macadamia research institute at KARI-Thika yielded big results in 1996 export statistics. Expanding produce are strawberries, mask melons, plums, guavas and peaches.

4) Other Produce

Miraa herb produced on the east slopes of Nyambene Hills is consumed in Nairobi, Garissa and Isiolo, and exported to Somalia and Yemen through Wilson Airport. But there are no statistics regarding this produce. In Mbeere District, this produce is beginning to be cultivated, but the taste is not accepted by market demand due to soil fertility.

7.3 Market Price Analysis

The current market prices information from Mondays to Fridays are collected and analysed by Market Information Branch (MIB) of Farm Management Division, MOALD. The information collection system is showing below;



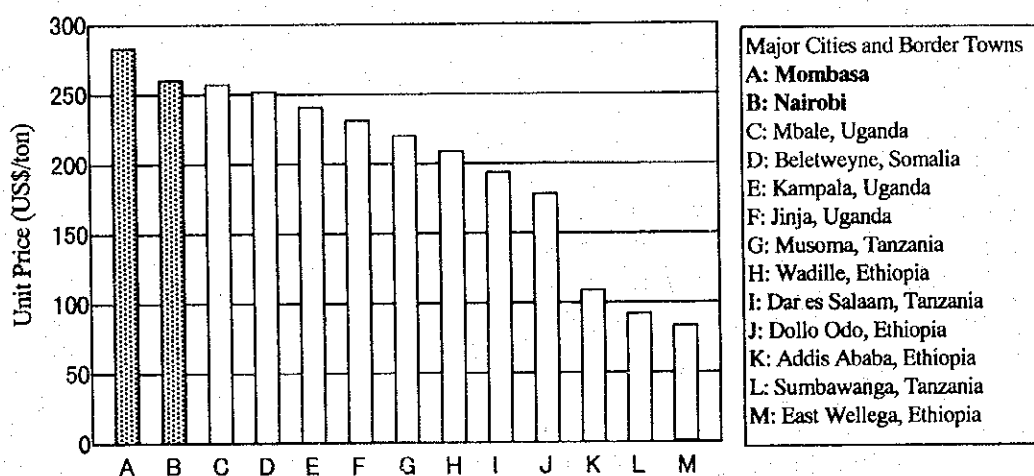
The monthly prices by crop in major markets in Kenya from October 1994 to July 1998 are showing in Figure N.1-11 to N.1-49, Annex N, and price fluctuation by crop and market is shown in Table N.1-23, Annex N. In the connection of price fluctuation, the coefficient of variation are computed by the value of the standard deviation divided by the mean, in order to compare the fluctuation by crop and market.

1) Maize, Dry and Green (refer to Figure N.1-33 and N.1-34, Annex N)

The dry maize is traded at high prices in Kenya comparing with the bordering countries. This is one factor to increase maize import from Tanzania, Uganda and also Ethiopia for northern districts.

Figure 7.3-1 and Figure 7.3-2 show the grains and horticultural production areas in Kenya and major flow of maize.

Maize Price Comparison in East Africa



- Major Cities and Border Towns
- A: Mombasa
 - B: Nairobi
 - C: Mbale, Uganda
 - D: Beletweyne, Somalia
 - E: Kampala, Uganda
 - F: Jinja, Uganda
 - G: Musoma, Tanzania
 - H: Wadille, Ethiopia
 - I: Dar es Salaam, Tanzania
 - J: Dollo Odo, Ethiopia
 - K: Addis Ababa, Ethiopia
 - L: Sumbawanga, Tanzania
 - M: East Wellega, Ethiopia

Source; FEWS, USAID

Note; The prices are as of February, 1997.

The maize prices are very affected by drought, and increased from 912 Ksh/bag in 1996 average to 1,523 Ksh/bag in March to July, 1997.

Price Fluctuation of Maize

Crop	Prices in Nairobi (Wakulima Wholesale Market) in Ksh/bag							
	1995 Ave.	1996 Ave.	1997 Ave.	1998 Ave. (until July)	Lowest	Highest (Mar-July 97)		
Dry Maize (90kg)	784	912	1,408	1,139	684	1,523		
Green Maize (114kg)	1,320	1,651	2,133	1,496	956	3,350		
Coefficient of Variation	Nairobi	M'sa	Nakuru	Kitale	Kisumu	Eldoret	Meru	Karatina
Dry Maize	0.263	0.187	0.353	0.415	0.363	0.397	0.311	0.289
Green Maize	0.319	0.334	0.400	0.312	0.261	0.425	0.317	0.416

Source; JICA Study Team based on the data provided by MIB

Figure 7.3-1

Location of Grains and Horticultural Production Areas

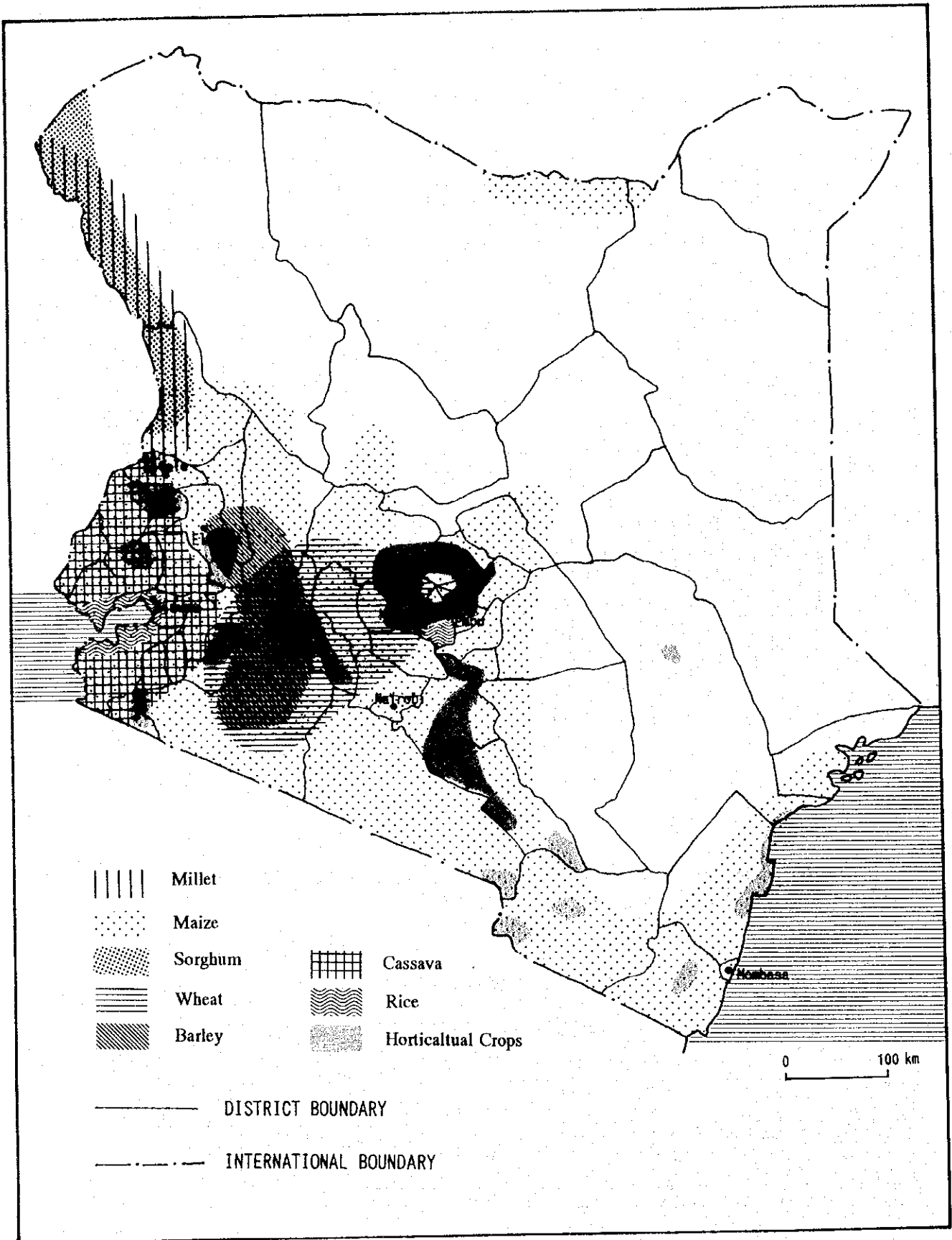
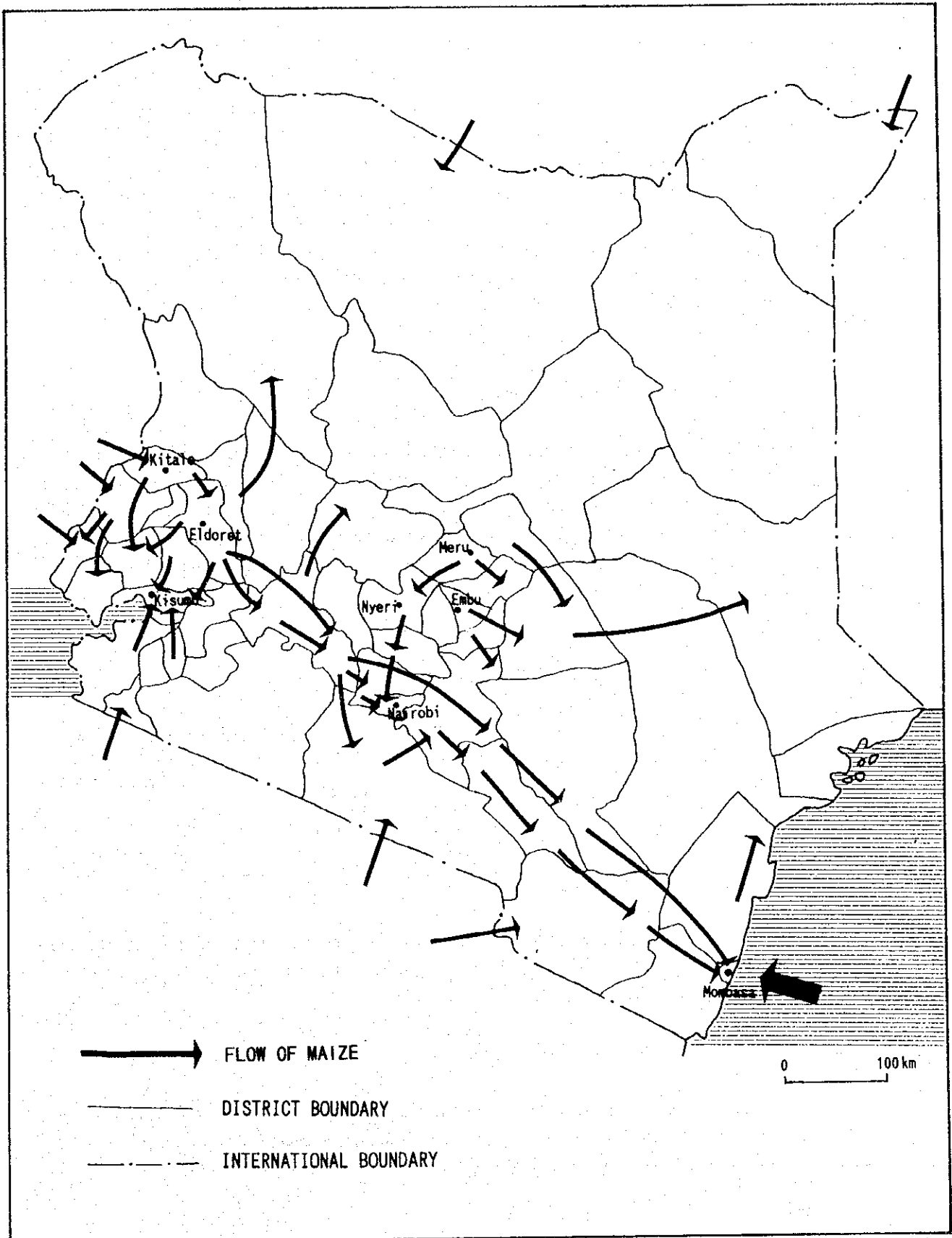


Figure 7.3-2

Flow of Maize in Kenya



The second factor is the distance from main maize producing areas, and normally the prices in Nairobi is higher at 20-50 percent than in Kitale and Eldoret. In the season in March to July, 1997, the prices of Nairobi and Mombasa are reversed because imported maize were off-loaded at Mombasa Port. In the Study Area, prices in Meru show almost same changes with Nairobi prices, but in Karatina, the fluctuation is larger than in Nairobi, which may be caused by much exploitation by middlemen or merchants. The heavy rain can also affect the maize prices in northern districts due to impassable roads. World Food Programme gave relief to those areas by airlifts in February, 1998, therefore, the food security must be considered including border trades. The Meru, Nyambene and Embu districts have important role to distribute maize to chronic vulnerable areas of north and south east parts of Eastern Province. In the viewpoints of food security, the National Cereals and Board needs to be subsidized only for distribution to chronic vulnerable areas during seasons of nasty weather conditions with consideration of border trades, even though the subsidy is antithetical concept to the streamline of the market liberalisation. The MIB needs to monitor price information of staple foods in major towns in border and semi-arid zone; Moyale, Mandera, Namanga, Busia, Wajir, Lodwar, etc.

2) Finger Millet (refer to Figure N.1-37, Annex N)

Since main millet producing areas are located along the border of Uganda, the prices in Meru and Karatina are higher at 2,972 Ksh/bag (176%) and 2,159 Ksh/bag (128%) respectively than 1,689 Ksh/bag in Nairobi in the averages of 1994-1998. The affection by drought is comparatively lower than other grains. Meru district despite being in a producing area had the highest prices including sorghum, because traders in this community buy produce at farmgate and transport in bulk to Nairobi and Mombasa hence a false domestic shortage was created that pushes up prices in Meru.

Price Fluctuation of Finger Millet

Crop	Prices in Nairobi (Wakulima Wholesale Market) in Ksh/bag							
	1995 Ave.	1996 Ave.	1997 Ave.	1998 Ave. (until July)	Lowest	Highest (Mar-May 97)		
Finger Millet	1,465	1,562	2,002	1,888	412	1.100		
Coefficient of Variation	Nairobi	M'sa	Nakuru	Kitale	Kisumu	Eldoret	Meru	Karatina
Finger Millet	0.179	0.149	0.257	0.287	0.258	0.296	0.219	0.151

Source; JICA Study Team based on the data provided by MIB

As the limited water resources in Kenya, the seed development and extension for this crop and bulrush millet must be reconsidered for food security in semi-arid areas including lower parts of Meru, Tharaka Nithi and Mbeere Districts.

3) Dry Beans (refer to Figure N.1-14 to N-1.17, Annex N)

The prices of dry beans including the varieties of Canadian Wonder, Dolichos, Mwiternania and Rose Coco are very fluctuated in all markets in Kenya. The drought was directly attached the prices at 225 to 260 percent comparing 1996 averages with highest price season in March to May in 1997.

In normal weather years, the high prices come in June to July for Canadian Wonder, June to July and November for Dolichos, May and December for Mwiternania, and June and November to December for Rose Coco. The Study Areas have desirable natural resources for the production of beans, therefore the construction of warehouses by marketing groups basis and multiplication of bean seeds in production areas lead by DAO will contribute the food security for the local and Nairobi areas. The prices of dry beans were affected by the supply of Uganda originated produce in February 1998.

Price Fluctuation of Dry Beans

Crop	Prices in Nairobi (Wakulima Wholesale Market) in Ksh/90kg bag							
	1995 Ave.	1996 Ave.	1997 Ave.	1998 Ave. (until July)	Lowest	Highest (Mar-May 97)		
Canadian Wonder	2,020	2,245	4,153	3,594	1,722	5,843		
Dolichos	2,788	2,997	4,742	4,397	1,992	6,762		
Mwiternania	1,556	2,264	4,115	2,493	1,246	5,888		
Rose Coco	2,053	2,386	4,309	3,878	1,895	5,898		
Coefficient of Variation	Nairobi	M'sa	Nakuru	Kitale	Kisumu	Eldoret	Meru	Karatina
Canadian Wonder	0.378	0.328	0.437	0.480	0.415	0.418	0.427	0.325
Dolichos	0.332	0.277	0.175	-	-	-	0.332	0.363
Mwiternania	0.454	0.462	0.445	0.560	-	0.504	0.569	0.563
Rose Coco	0.362	0.352	0.427	0.447	0.380	0.420	0.430	0.429

Source: JICA Study Team based on the data provided by MIB

4) Irish Potatoes (refer to Figure N.1-45 to N-1.46, Annex N)

The prices are affected not only by drought, but also heavy rain. In Nairobi, the red and white irish potatoes were jumped up to 2,725 Ksh/bag (296%) and 2,750 Ksh/bag (296%) from 921 Ksh/bag and 930 Ksh/bag in 1996 average. El Nino rain also affected on the prices from March to June 1998 due to impassable roads in production areas in Nakuru, Nyandarua and Nyeri Districts. The drop of prices is very huge comparing to other crops, e.g. from 2,750 Ksh/bag in April 1997 to 650 Ksh/bag in August 1997. The supply and demand are not balanced, so the business opportunities to operate cold storage are recognized. The prices in Mombasa are continuously higher at 130-200 percent than in Nairobi. Nyeri farmers of white irish potato may have alternative market outlet by trains from Karatina to Mombasa via Nairobi, which transporting means are more feasible by lorries due to heavy weights of potatoes and many empty train wagons from Nairobi to Mombasa. Meru farmers of red irish potato still have market outlet in Chuka, Embu, Kutus, Wanguru, Thika and Nairobi due to competitiveness in taste, but group loading arrangement not through middlemen is necessary to reduce intermediate margins.

Price Fluctuation of Irish Potatoes

Crop	Prices in Nairobi (Wakulima Wholesale Market) in Ksh/130kg bag							
	1995 Ave.	1996 Ave.	1997 Ave.	1998 Ave. (until July)	Lowest	Highest (April 97 -red May 98- white)		
Red Irish Potato	802	921	1,334	1,552	625	2,725		
White Irish Potato	731	930	1,390	1,764	600	2,993		
Coefficient of Variation	Nairobi	M'sa	Nakuru	Kitale	Kisumu	Eldoret	Meru	Karatina
Red Irish Potato	0.395	0.399	0.691	0.530	0.412	0.555	0.306	0.356
White Irish Potato	0.476	0.405	0.696	0.542	0.424	0.568	-	0.418

Source; JICA Study Team based on the data provided by MIB

5) Tomato (refer to Figure N.1-49, Annex N)

The prices of tomato are very fluctuated specially in April to May. The fluctuation in Nakuru and Karatina markets are caused by glut in same harvesting seasons, and the prices are increasing year by year. But high prices in 1998 year are caused by the prevailing diseases of tomato leaf curl, blossom end-rot, bacterial wilt, early and late blight.

Price Fluctuation of Tomato

Crop	Prices in Nairobi (Wakulima Wholesale Market) in Ksh/63.6kg box							
	1995 Ave.	1996 Ave.	1997 Ave.	1998 Ave. (until July)	Lowest	Highest (Jan 98)		
Tomato	909	1,094	1,269	2,100	606	2,818		
Coefficient of Variation	Nairobi	M'sa	Nakuru	Kitale	Kisumu	Eldoret	Meru	Karatina
Tomato	0.408	0.440	0.601	0.353	0.455	0.355	0.462	0.555

Source; JICA Study Team based on the data provided by MIB

The transport from Kirinyaga to Nairobi or Mombasa are used frequent, but the farmers are going to lose market share in Kenya.

Tomato Production

Province	Area		Production		Value	
	1996	1997	1996	1997	1996	1997
	(ha)		(ton)		(1,000K £)	
Nyanza	1,928	1,917	43,871	42,637	22,880	38,555
Central	4,293	4,369	69,112	59,578	48,886	37,588
Rift Valley	3,291	3,462	29,619	43,588	22,636	27,500
Western	1,512	1,535	22,742	24,406	17,380	21,473
Eastern	1,550	1,959	18,270	18,453	15,443	18,455
Coast	954	1,055	9,228	12,352	6,921	9,882
Nairobi	182	160	2,730	2,224	2,086	3,366
N/Eastern	70	128	638	1,827	319	3,197
Total	13,780	14,585	196,210	205,085	136,552	160,017

Source; Provincial Reports, 1996/97, MOALD

Nyanza province is not expanded in areas but the unit prices are increased due to shortage of supply from Central province. The increase of production in Rift Valley province was the wide contract with Kabazi Cannery in Nakuru district, but the tomatoes for processing purpose made cheaper unit price from 15.2 Ksh/kg in 1996 to 12.6 Ksh/kg in 1997. For Kirinyaga farmers, the countermeasures of the shifting to other crops or supply in April and May by popular variety of 'Money Maker' are required if this trend is continued.

6) Kale (refer to Figure N.1-29, Annex N)

Kale is highly demanded in all markets, which prices are very affected by weather conditions and rocketed up from 294 Ksh/bag in 1996 average to 1,471 Ksh in March 1997. Even in normal years, the seasonal fluctuation is the largest in all crops. In Kisumu and Eldoret markets, the prices took over of Nairobi occasionally. The prices in Mombasa are higher in all seasons at 20-100 percent than in Nairobi. Constantly, the prices in Meru and Karatina are stable and farmers in Meru and Kirinyaga have market outlets to Kisumu and Mombasa rather than to Nairobi.

Price Fluctuation of Kale

Crop	Prices in Nairobi (Wakulima Wholesale Market) in Ksh/90kg bag							
	1995 Ave.	1996 Ave.	1997 Ave.	1998 Ave. (until July)	Lowest	Highest (Mar 97)		
Kale	261	294	561	436	152	1,471		
Coefficient of Variation	Nairobi	M'sa	Nakuru	Kitale	Kisumu	Eldoret	Meru	Karatina
Kale	0.664	0.488	0.789	0.627	0.710	0.711	0.368	0.671

Kale Production

Province	Area		Production		Value	
	1996	1997	1996	1997	1996	1997
	(ha)		(ton)		(1,000K.£)	
Central	7,302	7,107	107,857	94,802	34,610	42,297
Rift Valley	4,640	5,197	64,960	72,236	20,845	34,118
Nyanza	2,275	3,230	33,948	52,115	11,785	16,878
Eastern	1,271	1,469	16,493	22,176	5,523	12,469
Western	1,962	2,356	14,906	18,479	6,406	8,468
Coast	533	560	4,252	4,259	1,913	3,194
Nairobi	220	198	2,860	1,124	918	562
N/Eastern	12	2	158	20	51	15
Total	18,215	20,119	245,434	265,211	82,051	118,002

Source; Provincial Reports, 1996/97, MOALD

The Central district has largest share, but production is decreasing due to low prices. The pressure of produce of Rift Valley make lower in Nairobi Market. For Kirinyaga and Nyeri farmers, the forwarding in February to March is desirable.

7) Onion, Dry Bulb (refer to Figure N.1-29, Annex N)

The prices of dry bulb onion is affected by heavy rain rather than drought, and rocked up at from 337 Ksh/net in 1997 average to 1,047 Ksh/net (309%) in May 1998. The high prices in 1998 brought the increase of import of Tanzanian originated onions, which are confirmed even in Embu, Karatina and Kutus, not only in Nairobi.

Price Fluctuation of Dry Bulb Onion

Crop	Prices in Nairobi (Wakulima Wholesale Market) in Ksh/13.2kg net							
	1995 Ave.	1996 Ave.	1997 Ave.	1998 Ave. (until July)	Lowest	Highest (May 98)		
Dry Bulb Onion	234	259	339	741	155	1,047		
Coefficient of Variation	Nairobi	M'sa	Nakuru	Kitale	Kisumu	Eldoret	Meru	Karatina
Dry Bulb Onion	0.594	0.646	0.579	0.495	0.335	0.781	0.419	0.626

Source; Provincial Reports, 1996/97, MOALD

In normal years, the prices are fluctuated in May to June in Karatina and Eldoret markets. Once the commercial based production plan was introduced in Embu District in 1996, but the prices were not meet with production costs. Only heavy rain happened, the farmers in study areas may have market outlets to local markets and Nairobi. The construction of cold stores can be one alternative for this produce in Karatina markets due to high traded prices at 111 percent of Nairobi.

Onion Production

Province	Area		Production		Value	
	1996	1997	1996	1997	1996	1997
	(ha)		(ton)		(1,000K £)	
Rift Valley	1,810	1,534	21,720	21,960	15,910	25,450
Nyanza	816	671	11,825	10,107	7,485	15,161
Eastern	792	950	8,351	8,170	6,117	12,255
Western	737	816	7,857	8,391	7,499	8,047
Central	827	968	5,940	7,060	4,351	6,364
Coast	169	176	994	1,276	994	1,467
Nairobi	18	25	252	78	183	78
N/Eastern	41	33	562	402	305	463
Total	5,210	5,173	57,501	57,444	42,844	69,285

Source; Provincial Reports, 1996/97, MOALD

Main produce areas are located in Rift Valley Province, the contract farming with National Irrigation Board (NIB) is now operating in Marigat district, and the large-scale farmers produce in commercial base in Bungoma and Mt. Elgon districts.

8) Cabbage (refer to Figure N.1-19, Annex N)

The prices of cabbage are very fluctuated by month, market and drought. The prices in Karatina are in extremely low at 33 percent of Nairobi. The cabbages are very bulky produce for transportation, but

the exploitation of traders are existing. The construction of cold storage for two or three months are very effective for Nairobi consumers with transport arrange and notice on the price information of Nairobi by farmers' groups.

Price Fluctuation of Cabbage

Crop	Prices in Nairobi (Wakulima Wholesale Market) in Ksh/126.2kg bag							
	1995 Ave.	1996 Ave.	1997 Ave.	1998 Ave. (until July)		Lowest	Highest (Mar 97)	
Cabbage	945	1,087	1,553	1,500		512	2,585	
Coefficient of Variation	Nairobi	M'sa	Nakuru	Kitale	Kisumu	Eldoret	Meru	Karatina
Cabbage	0.423	0.418	0.646	0.547	0.857	0.669	0.560	0.571

Source; JICA Study Team based on the data provided by MIB

The main producing areas are in Kirinyaga and Nyeri districts of Central Province and Meru of Eastern Provinces, where have still competitiveness with produce originated from Rift Valley Province specially Nakuru District.

Cabbage Production

Province	Area		Production		Value	
	1996	1997	1996	1997	1996	1997
	(ha)		(ton)		(1,000K £)	
Central	7,835	8,430	128,766	113,645	33,278	56,723
Rift Valley	5,620	5,222	89,936	76,370	28,871	38,185
Western	947	1,298	9,449	11,392	2,923	4,260
Eastern	765	771	10,180	14,454	3,948	3,884
Nyanza	838	946	17,309	17,943	5,557	3,887
Coast	115	180	1,980	3,102	950	2,327
Nairobi	56	-	840	-	270	-
Total	16,176	16,847	258,460	236,906	75,797	109,265

Source; Provincial Reports, 1996/97, MOALD

9) Carrot (refer to Figure N.1-22, Annex N)

The prices of carrot used to be stable until 1996, and rocked up from 923 Ksh/bag in 1996 average to 5,419 Ksh/bag in June 1997. The Kirinyaga and Nyeri districts as main producing areas had low productivity due to adverse weather conditions, and supply to the markets had declined. Meru market showed interesting trend during high price season in January to May 1997. Only that market remains in lower prices, which might prove the market information dissemination could be not prevailed.

Price Fluctuation of Carrot

Crop	Prices in Nairobi (Wakulima Wholesale Market) in Ksh/117kg bag							
	1995 Ave.	1996 Ave.	1997 Ave.	1998 Ave. (until July)		Lowest	Highest (Jun 97)	
Carrot	952	923	1,801	1,038		743	5,419	
Coefficient of Variation	Nairobi	M'sa	Nakuru	Kitale	Kisumu	Eldoret	Meru	Karatina
Carrot	0.742	0.605	0.517	0.368	0.132	0.534	0.275	0.579

Source; JICA Study Team based on the data provided by MIB

The production of Central province has large amounts of share in Kenya. As the price fluctuation has been huge in Nairobi market, the construction of cold storage at Karatina are very effective for suppliers and Nairobi consumers.

Carrot Production

Province	Area		Production		Value	
	1996	1997	1996	1997	1996	1997
	(ha)		(ton)		(1,000K £)	
Central	3,529	3,337	47,980	50,177	35,942	33,529
Rift Valley	532	502	280	5,856	168	4,392
Eastern	110	187	880	2,254	328	847
Nyanza	15	40	80	408	16	243
Western	55	70	200	279	78	133
Nairobi	5	6	15	26	9	13
Coast	14	-	3,724	-	2,790	-
Total	4,260	4,142	53,159	59,000	39,331	39,157

Source; Provincial Reports, 1996/97, MOALD

10) Banana, Ripe and Cooking (refer to Figure N.1-12 and N.1-13, Annex N)

The prices of banana are not so affected by the weather conditions comparing to other crops, but three times of waves at least come annually in Nairobi market in April, June and December. The prices of cooking banana in Meru are almost same level as of Kisumu until 1996, where has the biggest producing areas in Kenya, but the prices become fluctuated since 1997. Most of surplus bananas in Nyambene, Meru and Tharaka Nithi purchased by middlemen and sold in outside markets, and then supply shortage had been occurred. The production volume (28,800 ton in 1996) of those three districts are more than one of Nyeri and Kirinyaga districts (18,300 ton in 1996).

Price Fluctuation of Banana

Crop	Prices in Nairobi (Wakulima Wholesale Market) in Ksh/13.8kg bunch for cooking banana and in Ksh/22.0kg bunch for ripe banana							
	1995 Ave.	1996 Ave.	1997 Ave.	1998 Ave. (until July)	Lowest	Highest (Mar 98 -cooking Sep 96- ripe)		
Cooking Banana	158	164	171	206	138	259		
Ripe Banana	328	359	365	387	200	529		
Coefficient of Variation	Nairobi	M'sa	Nakuru	Kitale	Kisumu	Eldoret	Meru	Karatina
Cooking Banana	0.169	0.288	0.165	0.382	0.459	0.142	0.493	0.371
Ripe Banana	0.142	0.073	-	0.123	0.457	0.131	0.336	0.312

Source; JICA Study Team based on the data provided by MIB

The stabilizing prices in Eldoret by alternative inlets from Kisii and Ugandan originated produce, though there are not so produced cooking banana.

Banana Production

Province	Area		Production		Value	
	1996	1997	1996	1997	1996	1997
	(ha)		(ton)		(1,000K £)	
Nyanza	29,308	31,160	532,290	617,270	151,485	117,423
Central	17,025	16,800	187,742	150,890	90,475	70,429
Eastern	8,673	10,665	88,607	105,680	35,130	53,763
Coast	6,088	5,397	58,871	51,811	34,145	31,195
Western	7,448	8,152	82,708	89,506	26,749	29,241
Rift Valley	2,747	2,629	40,072	39,489	12,960	18,432
N/Eastern	245	297	281	2,762	101,722	3,453
Nairobi	64	31	640	178	207	178
Total	45,269	75,131	908,503	1,057,586	213,257	324,113

Source; Provincial Reports, 1996/97, MOALD

7.4 Assessment of Marketing Information Provision Systems and Its Penetration

The market information is provided by the Marketing Information Branch (MIB) under MOALD with the support of USAID Kenya Market Development Project. The price information is collected by marketing officers of headquarters and Department of Agriculture at district offices in Nairobi (Wakulima Wholesale Market for horticultural produce), Mombasa, Kitale, Kisumu, Eldoret, Meru, Karatina, Chuka, Kisii, Taita-Taveta, Nyeri, Kakamega, Nyamira and Nyahururu by produce trading units during early morning (8:00-10:00am), and telephoned or sent through facsimile to headquarters of Marketing Information Branch. The headquarters send parts of the information through facsimile to media of major newspapers, such as The Daily Nation, Standard, East African and Financial Time and Taifa, and KBC. The newspapers indicate the prices of the 35 commodities including cereals, pulses and eggs at five major cities of Nairobi, Mombasa, Nakuru, Kisumu and Kitale. Many stakeholders in horticultural marketing refer to this information and provide a base for price negotiations. However, the following constraints are found :

- Lack of information of price ranging by quality and specification of production area to create new brands and trading volume
- Difficulty on accurate price collecting by price enumerators due to individual negotiating transaction and insincerity of sellers without actual transaction
- Insufficient transporting vehicles and poor communication infrastructure for local marketing officers resulting in delay of data provision
- Deficient marketing seminars for farmers held by local marketing officers due to their limited budget allocation
- Lack of dissemination of Monthly Market Bulletin monitoring market trends issued by Marketing Information Branch to farmers or farmers' groups
- Loose coordination between Market Information Branch and City, Municipality Town and County Councils, who operate market facilities and collect cess levies to obtain trading volume information
- Undeveloped market information system through media such as radio broadcasting, which can provide such timely information with lower costs and reach places where newspapers are not delivered
- Lack of export produce information, but it will be improved by introduction of auction system under Horticultural Produce Handling Facilities Project funded by OECF with the cooperation with Marketing Information Branch
- No specified information regarding produce from Tanzania, the strong competitor, to Nairobi and Mombasa Markets, which is gradually creating borderless marketing within East African Community especially for onions and white potatoes, as well as cooking bananas from Uganda

7.5 Assessment of Marketing Related Organizations

The organizations related horticultural marketing are Marketing Information Branch (MIB), Horticultural Crops Development Authority (HCDA), Fresh Produce Exporters Association of Kenya (FPEAK), farmers' cooperative and farmers' marketing groups. Wholesalers and retailers are not forming their own organizations.

1) Marketing Information Branch

This section was organized under Farm Management Division, MOALD and the local farm management officers are currently dispatched to the Department of Agriculture in Nyambene, Meru, Embu, Kirinyaga and Nyeri Districts in the Study Areas. The policy of the Branch is to have Kenya being fully sufficient in food security. This will be done by encouraging the farmer to increase the hectareage under crop and providing water for irrigation in arid and semi arid regions as well as the other regions where water is readily available. The strategies of the Branch are;

- Provision of market date prices on livestock and agricultural activities as prerequisite to production through print and TV medias
- Provision of input of production as component affecting production
- Integration of state and private data on marketing provision
- Inter-regional exchange of data on market prices to significantly give the farmer a bargaining ground
- Production of exporters address and contact so that the farmer can deal directly instead of being exploited by the middlemen
- Development of roadside market in collaboration with local authority, which make the majority of

outlet means of horticultural produce

Despite the significant governmental role on provision of agricultural information for promotion of private sectors, the Branch is facing the following problems;

- Inadequate marketing seminars due to limited budget though there are demands from farmers and farmers' groups
- Insufficient transport equipment at district levels
- Lack of market information feedback system through media in price ranging according to quality and production area, number of sampled markets for Nairobi retailer markets, weekly market review, import situations, data of farm input prices, etc.
- Difficulty to obtain export produce prices, which are not being sold through markets presently
- Lack of computer network within the branch including printers and inefficient computer programme resulting in breakdown and difficult recovery, which happened in 1996
- Limited financial sources to train marketing officers, though the Branch give the highest priority for it. In 1996, one officer could be admitted to join Egerton University, but not to Jomo Kenyatta University of Agriculture and Technology

2) Horticultural Crops Development Authority (HCDA)

The Authority, the parastatal agency established in 1967, is mandated to promote horticultural produce marketing. The present activities are; a) provision of technical extension services in grading, storage, collection and transportation for export produce to farmers and advisory services to the government, exporters' association and distribution agencies, b) provision of market information including that of EU and middle-east countries to farmers and exporters, c) distribution of farm inputs procured by international aid such as the programme of Kennedy Round II, d) assisting smallholders by information to contact with traders, e) monitoring export prices and foreign exchange remittances to the country, f) regulating horticultural industry by licensing exporters and produce standardization, and g) operation of cold-chain marketing facilities additionally enacted in June, 1995. In order to create fair, free and transparent transaction system in export produce, the Authority is going to operate one auction center and seven precooling facilities which will be opened in early 1999. However, the Authority needs technical assistance from Japan because auctioning system in horticultural produce is scarcely operated in the world, and those are assessed as the highest priority for Kenya's sustainable horticultural development for smallholders in the following aspects :

- Auctioning
- Construction and operation of information feedback system
- Banking system including deduction of consignment charges and immediate payment to farmers

3) The Fresh Produce Exporters Association of Kenya (FPEAK)

The association of exporters was founded in 1995 with the objectives of; a) promotion of horticultural production and export, currently concentrating in cutflowers, b) lobby to the government to solve the exporters' constraints and policymaking, c) collection and circulation of useful information in EU and middle-east markets within members of the Association, for example maximum residue levels, and d) cosponsoring agricultural shows such as Hortech Nairobi Show. This Association is an important

information source particularly for medium- and small-scale exporters and newcomers.

4) Farmers' Groups

The government of Kenya including the Ministry of Cooperatives has made great efforts to organize farmers' group in the horticultural sector. In the late 1980 to early 1990, there used to exist a large scale of horticultural cooperatives, but they have collapsed at present. The following lessons are reported from the failure of Horticultural Cooperative in Manyatta Division in Embu District organized for the contract production with three exporters for French beans :

- Overwhelming presence of provincial administration in coordination committee
- Mismanagement and embezzlement of money of member farmers
- In-fighting among farmers due to lack of trust or resulting from the above monetary problems

In order to organize or improve farmers' marketing groups, the following conditions shall be required:

- Smaller unit groups of about 20-30 members to simplify their decision-making
- Creation of the system of direct sale in markets and to recognize market demands in quality for domestic consumed produce
- Transparent pricing system and quick payment to member farmers for export produce, which may be within seven days or less
- Improvement of timely market information provision system through radio including farm inputs
- Operation of grading shed, stores and group forwarding to maintain produce quality and price
- Provision of integrated technical advises from District Marketing/Farm input/Horticultural Officers and HCDA Marketing Experts and their coordination as a task force to interchange each information, which services can be considered in a pay basis
- Avoidance of excessive political interference in groups' decision-making
- Funds for purchase of farm inputs and construction of simple post-harvest facilities in soft loan conditions at 15 percent or less interest rate per year
- Strengthening of the linkage among small marketing groups to establish higher position in transaction than that of middlemen by information exchange

7.6 Marketing Facility Assessment

The major market facilities are located along main roads of A2 (Nairobi-Moyale) and B6 (Makutano-Meru) circulating Mt. Kenya. The markets with wholesaling function are Karatina, Nyeri, Meru (called Gakoromone), Nkubu, Embu, Kutus and Kagio Markets, where the transporting centers of each horticultural production area are concentrated.

From these markets or areas, the produce are delivered to the large consuming areas at Nairobi, Mombasa, Nakuru, Kisumu and Eldoret by traders. Most have markets 'market days' to avoid duplication in the neighbouring areas and concentrate trading; e.g. a) Karatina Market (Tuesdays, Thursdays & Saturdays) and Nyeri Market (Mondays, Wednesdays & Fridays) in Nyeri District, b) Gakoromone Market (Mondays, Wednesdays & Fridays) and Nkubu Market (Tuesdays, Thursdays & Saturdays) in Meru District.

The market facilities are managed by municipality, town and county councils and the market superintendents of councils collect cess levies from wholesalers and retailers by unit of truck, bag or stall. The charges range from 10-20 Ksh/bag, 500-700 Ksh/truck and 10-20 Ksh/stall, which are comparatively higher charges than in markets in Kirinyaga District. These collected amounts are used for garbage disposal, wages for cleaners and watchmen, maintenance of facilities such as toilet, fencing, etc. and remuneration of council staff.

The improvement of market facilities are described in the "District Development Plan 1997-2001" in all districts and given the highest priority. The constraints in general and in major markets can be summarized as follows;

1) General Constraints

- Lack of inspection system of weighing for fair trade
- No roofing, though the walls in Karatina Market and a part of Nyeri Wholesale Market are in existence
- Inadequate information exchange between district marketing officers/enumerators and market superintendents of councils
- Insufficient sheds for short-term storing

2) Karatina Market

- No cold storage facilities for tomatoes, white potatoes, dry bulb onions and cabbages in spite of high fluctuation in prices
- Limited loading space
- Design of stalls on wall sides, which do not consider the flow of customers
- Poor facilities on dusty ground, lack of drainage, poor shed and security facilities, and an annexed wholesale market for potatoes and tomatoes

3) Nyeri Market

- Very cramped space to meet numbers of retailers (transfer to Mjinga market site)
- Dusty ground
- Limited loading space since the market is located on a small plot in the town center
- Mixture of retailers and wholesalers in an annexed wholesale market

4) Gakoromone Market

- No facilities suitable as a market at all, though Meru is the second largest market in horticultural production areas in Kenya
- Dusty ground and large-scale soil erosion
- About 300m of unpaved and sloped access road connected to B6 principal road
- No hygienic facilities such as water supply, drainage and toilets
- Difficulty in collection of cess levies due to closed situation, which is a critical matter for fairness among retailers
- No cold storage facilities for red potatoes, dry bulb onions, carrots, cabbages and fresh peas
- Unbalanced produce supply due to the combination of market days with Nkubu Market
- No liaison office for marketing officers, which cause delays in information to headquarters

5) Embu Market

This market has been improved with the assistance of the NGOs, Plan International, and opened in 1996. The separation of wholesalers and retailers is successful. The concrete floor, enclosed wall, drainage, loading space and the flow of people and produce are well-considered.

The outlines including minor markets are showing in Table N.1-6, Annex N. The markets, where the spaces are not enough to deal with the current supply volume, are Karatina, Nyeri, Mukurueine, Kagio, Wanguru, Embu, Chuka, Gakoromone and Nkubu markets. For efficient transaction, the separation of wholesale and retail functions is a critical matter, but the wholesale spaces are given only for Karatina, Embu and Nyeri markets. Most of markets are not facilitated loading spaces except Kutus and low trading volume of markets. The accessibility to market entrance is also an important factor for traders and even for farmers, but Kutus and Gakoromone markets are not facilitated by tarmac from the main roads. The facility infrastructures are comparatively improved only in Karatina, Embu and Maua markets. Gakoromone market as the second largest scale in Study Areas has the most serious problem that the prices of commodities in spite of the centre of producing areas become higher than Nairobi market. The market can not gather produce due to poor market infrastructure, and the shortage of millet, banana, cabbage, etc. had been occurred occasionally.

The improved road network conducts to extend the number of markets like Kirinyaga District. In Kagio market, farmers do not enter in the market, but they trade in the spaces along the road mainly for tomatoes due to equal chance of transaction, easier loading of packaged produce and parking of lorries, which indicate the importance or demands from farmers of road side shops along tarmac roads. The GOK needs to coordinate legal matters using space along roads for promotion of efficient transaction in agricultural produce and release or lease of the public lands.

7.7 Producers' Support Services and Credit Facilities

The institutional marketing support services are being conducted by district marketing officers and HCDA marketing experts. Marketing officers hold seminars for the trends in domestic markets using their publishing monthly market bulletin and row price data in 16 districts.

The exporters also provide marketing services with the provision of quality seeds and pesticides on a contract basis. However, contract farming has only succeeded in limited numbers around Timau and Naromoru by large-scale exporters; Homegrown, Everest, Wilham, KHE, Vegpro, and others. The exporters also tried to organize farmers groups; however, most exporters withdrew to make contracts with farmers and purchase commodities on a noncontract basis from farmers or middlemen.

HCDA advises farmers' groups regarding promotion of post-harvest techniques and construction of grading and collecting sheds to meet demands from exporters. In accordance with the completion of OECF-funded Horticultural Produce Handling Facilities Project, the role of HCDA in marketing support services will be more significant and be able to provide more accurate information based on daily auction results in Nairobi Horticultural Center. Expected information services will consist of auctioned prices by crop, quality and production locations. The practical services will be collection of produce at the Satellite

Depots by dry-van truck, inspection of grading, precooling, transport to Nairobi by insulated-van trucks, cold storage until market closing and consigning sale, i.e. auction. These activities will create a fair and transparent pricing system, which has not been achieved in the agricultural sector in Kenya.

The interest rates of the Central Bank of Kenya and inflation rates are indicated the following;

The Interest and Inflation Rates

Indicators	Year	Month												Ave.
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
a. Interest Rates														
Overdraft	1997	28.7	28.4	28.5	28.2	28.8	28.5	27.7	27.4	29.0	29.7	30.3	30.4	28.8
	1998	30.4	30.4	30.8	29.3	30.7	29.6	30.2	30.6	29.8	29.6	28.8	N.A.	30.0
Treasury Bill	1997	21.6	21.4	21.4	21.1	20.4	19.4	18.5	19.7	26.2	27.1	26.8	26.4	22.5
	1998	26.3	26.3	26.7	27.0	26.4	25.5	24.7	23.9	22.5	20.6	17.7	12.6	23.4
Interbank	1997	14.4	11.2	12.9	13.2	15.1	12.9	14.8	17.6	26.9	23.1	25.4	18.7	17.2
	1998	21.2	28.9	24.2	25.8	25.1	21.7	17.3	23.6	19.0	16.4	10.9	8.8	20.2
3-months deposit	1997	16.1	15.8	15.9	15.7	18.1	17.0	16.8	16.8	17.5	19.1	19.8	20.0	17.4
	1998	19.6	19.9	20.1	21.7	21.2	21.2	19.9	19.7	19.1	18.1	16.7	N.A.	19.7
Saving	1997	10.9	10.9	10.9	11.0	12.4	10.6	10.8	10.8	10.7	11.1	11.8	9.7	11.0
	1998	9.8	11.7	9.8	10.8	11.2	10.8	11.5	10.8	10.5	9.7	9.5	N.A.	10.6
b. Underlying Inflation														
3-month	1997	8.6	3.8	4.2	3.9	2.6	-1.4	-0.8	4.2	13.2	15.1	10.8	6.2	5.9
Annualised	1998	10.5	26.4	34.2	25.9	3.3	-4.7	-3.7	0.3	1.6	2.6	3.6	3.7	8.6
Month-on-month	1997	9.7	9.6	7.3	7.3	6.9	4.8	4.6	5.7	6.8	6.5	5.3	5.4	6.7
	1998	7.0	10.6	12.3	12.3	10.8	11.3	11.4	9.8	8.4	8.3	7.9	7.7	9.8
Average Annual	1997	8.7	9.1	9.0	8.9	8.8	8.5	8.1	7.9	7.7	7.5	7.1	6.6	8.2
	1998	6.4	6.5	7.0	7.4	7.7	8.3	8.8	9.1	9.3	9.4	9.6	9.8	8.3
c. Overall Inflation														
3-month	1997	9.4	14.8	35.7	32.6	33.7	4.3	-7.1	15.5	-5.2	3.9	5.5	2.7	12.2
Annualised	1998	19.9	33.4	34.7	13.1	0.6	1.5	10.4	-13.6	-16.7	-24.0	-3.2	-3.1	4.4
Month-on-month	1997	10.8	11.9	15.7	16.1	17.2	12.8	8.9	7.7	8.8	8.7	8.2	8.3	11.3
	1998	11.3	12.3	8.1	7.0	4.6	7.4	11.7	5.2	4.0	3.3	3.0	2.5	6.7
Average Annual	1997	9.4	9.9	10.7	11.5	12.3	12.6	12.3	12.0	11.9	11.7	11.4	11.2	11.4
	1998	11.2	11.3	10.6	9.9	8.8	8.4	8.6	8.4	8.1	7.6	7.1	6.6	8.9

Source; Central Bank of Kenya (CBK)

The CBK has policies to stabilize prices and lower inflation, therefore the money supply (M3) maintained at the annual changes of only 5.2 percent in 1997/98 and 9.9 percent in 1998/99 (target). In order to control money supply and prevent from outflow of money, the CBK set high interest rates. Assuming the lending rates are more than the interbank rates at 3 percent for bank charges, the lending rate to private sector would be set on about 20 percent in 1997 and 23 percent in 1998 in annual averages. On the other hand, the EIRR of Feasibility Study areas are counted at 22.5 percent in Ngomano/Nyangati, 6.6 percent in Rupingazi Ngerwe, 5.9 percent in Nkunjumo and 3.6 percent in Ruungu/ Karocho. In the rates of commercial banks, the domestic produce can not meet to return debts. Under these circumstances, the possible lending system for domestic producing farmers may be suggested as alternatives in the following;

- i) Funding farmers themselves, without borrowing from any credit facilities, and deposit to the bank.
- ii) Utilizing JICA's Grass Root Grand Aid with establishment or utilization of existing institutes of operation body. The overall inflation rate in previous year was at 11.4 percent when serious

drought was attacked, therefore, at least 12 percent of interest rate is required in lower side. The proposed lending rate will be at the range of 12 -16 percent, though the three month deposit rate is higher.

Comparison of Lending Interest and Inflation Rates

Rate	Comparative Indices	Constrains (Loan Conditions)
28-35%	Commercial Banks (1998) such as Cooperative Bank, Kenya Commercial Bank, Barclay Bank, Standard Chartered Bank; development loan	There is possibility farmers can not return debts. (Title deed or immovable assets for security, various return period & no grace period)
22.0%	KTDA SACCO (1998); development loan	(Shares for security, 2 years of return period & no grace period)
20.2%	Interbank rate (1998 ave.)	
20.0%	Agricultural Finance Bank (1988); development loan and working capital <no function in majority areas>	(Title deed for security, 1-5 years for development loan/ 1-3 years for working capital of repayment periods & 1 year of grace period)
19.7%	3-month deposit rate (1988 ave.)	3-month deposit of money to bank is better.
18.0%	Mwea Multi-purpose Cooperative Society (1988); development loan and farm input loan	(Shares/ crops in fields for security, 1 year of repayment period & no grace period)
17.8%	Commercial Banks; projected lending rate (1999)*	
17.0%	Kirinyaga Cooperation Union (1988) farm input loan	(Delivered coffee cherries, 1 year of repayment period & no grace period)
12-16%	12% (proposed rate in Feasibility Study)	(1 year of grace period is desirable.)
11.4%	Overall inflation rate (1997 ave.)	Revolving system can not be sustained.
10.6%	Saving rate (1998 ave.)	Saving of money to bank is better.
8.9%	Overall inflation rate (1998 ave.)	
8.3%	Underlying inflation rate (1998 ave.)	

Note; * According to CBK monetary policy in the 12 months to June 1999, CBK Monetary Policy Statement FY 1998-99

- iii) Borrowing from and contracting for the produce with processing companies, but requiring for functional arbitrators and strict observance for each party.

7.8 Pre and Post Harvest Handling

The following constraints on the pre and post harvest treatment for horticulture crops are confirmed;

Application of Pesticides

- High costs, which might reach a quarter of production costs in case of export produce
- Difficult bulk purchase due to disorganization of cooperatives
- Lack of recording, though this is a basic factor in clearing maximum residue levels
- Use of cheaper old type chemicals, which need large volumes to spray and increase residue levels

Grading

- Discontinuity of collection by middlemen resulting in improper harvesting and grading
- No evaluation of feedback system in pricing of graded commodities to farmers in spite of efforts

of district horticultural officers and HCDA staff

Precooling

- Non-availability of cooling system at the production level, but this will be improved around Nkubu, Mwea and Sagana by the provision of precooling facilities to be constructed the OECF project

Cold Storage

- Non-availability of cold storage system at market level to cope with short-supply periods

7.9 Quality Control and Packaging

The quality control and institutional quality evaluation system are not carried out for domestic markets. While export produce, the exporters and MOALD inspect the maturity, size, weighing and damage mainly at Export Processing Zone nearby JKIA. KARI at Nairobi provide inspection services on a pay basis for chemical residue, which laboratory equipment had procured under the programme by Overseas Development Agency of the United Kingdom.

Packaging for horticultural produce in Kenya is commonly categorized as follows:

- Sisal or polyethylene bag
Rosecoco/ mwitemania/ dolichos beans, potato, cabbage, carrot, spring onion, kale, orange, fresh pea, cow pea, green gram, avocado, brinjar, cassava, cucumber, lettuce, mango, passion fruit, sweet potato, ground nut, chili
- Net bag
Dry onion, lime, okra
- Carton box
All export produce including cutflowers
- Wooden box
Tomato
- Bulk
Cabbage, pineapple, carrot, banana, watermelon, melon
- Plastic crate
Used for export produce and limited retailers in Nairobi only for enclosed transactions
- Vinyl bag
Used for retailing stage and supermarkets
- Imported polystyrene tray with wrapping and labelling
Used for French bean, snow pea and snap pea by limited exporters who contract with supermarkets in EU countries

The industries of packing materials such as carton boxes and plastic crates are expanding, with factories located in Nairobi Industrial Zone, however, the costs are still high due to using imported materials with high custom duties. In the Study Areas, usage of plastic crates is increasing.

7.10 Marketing in Community Levels

The position of farmers in transactions is relatively lower than that of buyers. Middlemen charge margins of about 50-100 percent of farmgate price. The prices offered by middlemen are normally accepted by farmers, which are found in isolated areas from tarmac roads specially; Kiene West and East Divisions in Nyeri District, Mbeere District except areas along B7 (Embu-Kibwezi), lower areas in Tharaka Nithi District, lower areas in Meru District, and Nyambene District except areas along C91 (Meru-Maua). In these areas, middlemen collecting or purchasing produce are very limited in number and collude in buying prices, therefore farmers cannot refuse middlemen's offering prices. Another issue for farmers is that the collecting day and time is not fixed, therefore, the farmers or their represents must wait for middlemen at collection points beside roads until their visits. For sensitive produce by heat and drying such as French bean, snow pea and karella, this current transaction causes huge post-harvest losses in quality and reduced prices.

The causes of low farmers return and poor marketing system at the community level are summarized below;

- Lack of Information on Production Elsewhere (Outside and Inside Kenya)
- Bargaining Power of Farmers
 - Collusion among Middlemen
 - Lack of Auction System
 - Risks Selling Export Produce in Domestic Market
 - Kenyan Eating Habits
 - No Alternative Marketing Outlet
 - Unequal Partners in Transaction in connection with Organization Problems
 - Opportunistic Farmers' Consideration (Short Term View i.e. Few Benefits)
- Lack of Access to Markets
 - Poor Marketing Channels
 - Poor Transportation System including Poor Road Conditions
- High Margin by Middlemen
 - High Transport Costs
 - Lack of Market Information for the Farmers
- Seasonal Gluts in Demand and Supply
 - Lack of Market Information for the Farmers
 - Lack of Storage in Production Areas
- Failure of Contract Farming in connection with Organization Problem