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JICA-CIDA JOINT EVALUATION STUDY REPORT ON THE KILIMANJARO AGRICULTURAL DEVELOPMENT PROJECT (KADP) IN TANZANIA

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JICA-CIDA Joint Evaluation Study Report
on the Kilimanjaro Agricultural Development Project
(KADP) in the United Republic of Tanzania

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Executive Summary

Some 30 years ago, President Nyerere requested a Japanese mission to Tanzania to "transform" the foot of Mt. Kilimanjaro with 100 years of Japanese experience. This was the origin of Japan's cooperation in the development of the Kilimanjaro region. At present, the Kilimanjaro Agricultural Development Project (KADP) seems to be bringing part of those wishes to reality. The KADP project turned the savanna landscape of Lower Moshie district into an irrigated farmland producing rice, generating income, creating employment, empowering women, and Japan/Tanzania cooperation.

As a result of on going cooperation between the Japan International Cooperation Agency (JICA) and the Canadian International Development Agency (CIDA) an agreement was reached to conduct a joint evaluation on the Kilimanjaro Agricultural Development Project (KADP) for the purpose of learning from each others' experiences. The evaluation team was made up of both JICA and CIDA personnel. The results of this report represent a total team concensus with all decisions, methodology, field survey and lessons learned being unanimous.

1 Subject Description

In accordance with the 1978 Integrated Regional Development Plan, Govermment of Tanzania and the Government of Japan agreed to concentrate cooperation in the areas of irrigated agriculture, small scale industrial development, rural electrification, and water resource studies in the Kilimanjaro area. The Kilimanjaro Agricultural Development Center (KADC) operated from 1978 to 1986 when the shift was made form experimental pilot farms and agricultural training to a more large scale production-oriented project. The Kilimanjaro Agricultural Development Project (KADP) which began in 1986 is not only concerned with a large area of irrigated paddy rice but also the regional benefits related to the impact of the principal project as well as a continuation of some aspects of the KADC. By applying an adequate amount of resources over an extended period of time together with logical integration JICA was able to make an enormous contribution to the development of the Kilimanjaro region.

The project was one of the largest agricultural technical cooperation efforts and combines the use of several development instruments to reach the desired goals. Aside from technical cooperation the impacts are enhanced through the use of Japanese yen loans, and capital grant aid.

2 Evaluation Description

The joint team utilized the Project Cycle Management (PCM) methodology in this project. This approace is based on the Logical Framework Analysis whice is utilized commonly with both JICA and CIDA. The two components of the team met in London and went over the available documentation prior to visiting the project site in Tanzania. The group divided into five sub groups in order to carry out separate surveys, and each team included at least one national, and one counterpart. Each sub-group took dhange of economic aspects, agriculture, water management, social aspects, and health considerations, respectively.

3 Major Findings

(1) Increased Income

The KADP has been an extremely successful project as was indicated by the positive impacts noted in the report. The team found an increase in net farm income as well as incresed profitability both wihin and outside the project area. There was also an increase in income opportunities and we noticed an increase in off-farm income as a result of the project. As a direct result of this project over 1000 jobs were created within the project boundary, and over 5000 jobs in the whole area.

(2) Improved Standard of Living

Basic human needs and the general standard of living int the region has been enhanced by the presence of this project. For example within the project area there has been a marked increase in new bousing and domestic water supply. The increase in electrification is almost 5 times in a twelve year period, partly owing to the complimentary Japanese grant aid power distribution project.

(3) Food Supply and Diversification

In addition to contributing to Tanzania's food suppply (30,845 tons) this project has led to a general agricultural divesfication and subsequently better nutrition. The agriculture extension service has been expanded and made to be more effective thorough the technical assistance of Japanee experts. Rice yields prior to the existence of the project were approximately 2 tons per hectare, and now some farmers are harvesting over 6 tons per hectare.

(4) Health Considerations

There have also been constraints to the success of this project. The increased water to the project area is no doubt partially responsible for the increase in malaria, and intestinal schistosomiasis whice are endemic in the area. Another challenge has been the fact thet when the outside farmers saw the success of the farmers in the project area they intercepted some of the water supply and caused a shortage in the project side. Measures are being taken at present to overcome both of these obstacles and the team was convinced that they would not constitute obstacles for the logical expansion of this project.

4 Conclusion

JICA contitued its emphasis of technical cooperation for nearly 20 years on this long standing development initiative in the Kilimanjaro region or capacity development of sustainable agriculture. With this continuous effort in collaboration with the Tanzanian Government, the Kilimanjaro region now has a substantially improved agricultural base, as well as a solid socioeconomic platform that would otherwise not be possible.

CIDA has benefited from its participation in this exercise as there is now a much greater understanding of how JICA plans, implements and monitors bilateral development projects. While there can always be improvements, the impact of this project on the Kilimanjaro region is extremely positive and the technology transfer is helping to insure its sustainability.

Introduction

In 1978, Japan International Cooperation Agency (JICA) assisted the Government of Tanzania in completing the design of an Integrated Regional Development Plan (IRDP) in Kilimanjaro region which aimed at providing equal development opportunities to the country's regions. As part of this effort, the Kilimanjaro Agricultural Development Center (KADC) was established.

KADC started operations in 1978 and ended them in 1986. During this period, the Center operated a 10 ha trial farm and a 100 ha pilot farm for training farmers and extension officers, conducted experiments on rice production, and researched into rice varieties best suited to the region. While KADC was in operation, the construction of an irrigation project in Lower Moshi area (2,300 ha) also commenced.

The Kilimanjaro Agricultural Development Project (KADP) began in 1986, succeeding the KADC activities, and ended in 1993. Advisory activities were extended to the neighboring areas of the project site, where farmers plowing the neighboring farm lands greatly benefited from training and technical advice on rice production provided by extension officers. KADP is one of the largest agricultural technical cooperation projects involving JICA's collaboration in Africa. It was unique because of the concentration of Japanese yen loans, capital grant aid and technical cooperation in the same area during the same period.

As a result of this project, rice production has spread to cultivable farm land throughout the region wherever water is available. Noticeable socio-economic changes are also taking place in the region. In light of the increasing food demand in Tanzania and throughout Africa, it is highly important and valuable to learn why and how this project was successful and to draw from it lessons for replication in other regions and countries. To this end, JICA started technical cooperation in establishing the Kilimanjaro Agriculture Training Centre (KATC) in 1995 to disseminate the experiences of rice production in Kilimanjaro throughout Tanzania.

With this in mind, JICA and CIDA agreed to conduct a joint evaluation of KADP in order to contribute to sustainable agricultural development in Africa by sharing their experiences. The joint evaluation team was organized by five persons from JICA and three persons from CIDA. A series of discussions were held to clarify the facts, exchange views and information, and deepen mutual understanding. Consequently, the lessons drawn from this project could highlight the crucial elements essential to success in rice production and point the way to sustainable agricultural development generally and in the Kilimanjaro region in particular.

This joint evaluation focused on the technical cooperation of the KADP project. However, contributions of Yen loan and capital grant aid to the project were also taken into consideration as additional inputs to the KADP project. It was found inappropriate to evaluate the results and accountability of the project without considering the complementary nature of these inputs.

1 Objectives

The joint evaluation of the Kilimanjaro Agricultural Development Project (KADP) was planned in order to achieve the following three objectives:

(1) To draw lessons from KADP for future sustainable agricultural development in the Kilimanjaro region, and later to apply the lessons to other parts of Tanzania and throughout Africa;

(2) To assess the accountability of KADP as a basis for promoting better understanding of development issues among the general public in Japan;

(3) To share JICA's experience in Africa with other donor agencies and to provide Tanzania and other African countries with feedback of donor's perspectives on the bilateral and multilateral development partnership.

KADP was selected for the joint evaluation because:

(1) KADP combines agricultural and environmental considerations which are of crucial importance to sustainable development in Africa.

(2) It has measurable positive and negative impacts, making it easy to grasp the project's consequences more objectively.

(3) KADP is considered one of the most progressive projects supported by JICA in Africa.

(4) KADP has been completed, but two Japanese experts are still working on the project and can assist in data collection.

2 Methodology

2-1 Use of Project Cycle Management (PCM) Methodology

The Joint Evaluation Team held a consultation meeting prior to its arrival in Tanzania and agreed to apply the PCM method as its evaluation methodology. PCM is commonly used by JICA as an objective-oriented management methodology using a logical framework as its basic tool. The Project Design Matrix (PDM) of KADP was designed by the Joint Evaluation Team, since it had not been prepared at the planning stage. The following methodological steps were undertaken by the Team to ensure an effective and efficient joint evaluation:

Step 1: To prepare the PDM, based on the Project concept identified in the Project documents

Step 2: To develop the upper part of the Impact Tree, based on noticeable positive and negative consequences that prevailed at the time

Step 3: To identify several clusters by subject area, each of which would consist of sectoral consequences on the Impact Tree and to organize the sub-teams to conduct a study on each cluster

Step 4: To elaborate on a checklist of items for evaluation under each subject area

Step 5: To design a questionnaire on each item for data collection

Step 6: To plan a working schedule by subject area consistent with the method of data collection and field work

Step 7: To undertake data collection

Step 8: To consolidate the findings by each group of the study team

Step 9: To identify and conclude key elements for achieving sustainable agricultural development

Step 10: To write a report

In accordance with the above methodology, the following five sectoral groups were identified. The Joint Evaluation Team was reorganized into five sub-groups accordingly, and each sub-group had one national consultant and one counterpart.

Economic aspects

Agriculture

Water management

Social environments

Health aspects

The PDM is shown in Table 2-1 and the identified clusters of sectoral consequences on the Impact Tree are shown in Chart 2-1.

2-2 Impacts and Sustainability

Among the five evaluation criteria (efficiency, effectiveness, impact, rationale and sustainability), the Joint Evaluation Team focused on impact and sustainability as areas of particular importance in Africa's development projects. The Team was keenly aware of the fact that many donor-supported development projects in Africa have had problems of limited impact and lack of sustainability mainly because of the weak capacity of implementing and related institutions. Therefore, in accordance with the PCM methodology, Steps two through five in the above were cautiously worked out to pay special attention to impact and sustainability.

Over ten years have passed since the beginning of KADP in 1986. If the KADC period is added, then the total cooperation period exceeds 19 years, including the eight years of KADC, two years of follow-up and another two years by the individual experts involved. What is the meaning and significance of this long cooperation period? What kind of impacts have been generated out of the project? Why has this project necessitated such a long period of cooperation? What conditions or elements hinder the project's sustainability? These questions are raised to learn lessons from the project.

According to the Project Design Matrix in Table 2-1 and the Impact Tree in Chart 2-1, each sub-group picked up the indicators related to its own subject and further elaborated on them to find relevant evidence to prove project impacts. The main focus of each sub-group by subject area was as follows:

Economic aspects:	Increased farmer income
	Created employment
	Change of consumption pattern
	Increase in food supply
Agriculture:	Increase in rice production
	Dissemination of rice production technology
	Technological level of farmers including cultivation method
Water management:	Water management institution
	Maintenance of irrigation system
	Optimum use of water and soil conditions
Social environments:	Social changes in villages
	Gender issues
	Behavioral changes of villagers
Health aspects:	Nutritional levels of villagers
	Infectious diseases (schistosomiasis and malaria)

As for the results of the Project, Tanzanian officials often said that the Project was successful. However, it was noted in the last few years that there were some negative consequences evident in the Lower Moshi area. The clearest negative consequence was the shortage of water in the project site (irrigated 2,300 ha), which gave rise to conflicts over water distribution. The water management group dealt with this incident carefully.

Other reports indicated that infectious diseases such as schistosomiasis and malaria had increased recently. It was not clear how this occurred and the causal relationship between the project's irrigation system and infectious diseases was yet to be studied. The health aspects group surveyed this incident.

Agricultural development in Africa requires special attention to environmental sustainability. Many Sub-Saharan countries are affected by southward desertification. Therefore, it is of critical importance that the best use of water be given highest priority in the area. Tanzania is no exception. There used to be much debate in Japanese aid circles as to whether or not irrigated rice production, which requires large amounts of

water, was appropriate to the Kilimanjaro region where water is a scarce resource.

Thanks to Mt. Kilimanjaro, the region has considerable rainfall throughout the year. Hence, the project area around the foot of the mountain is endowed with spring water in many places. However, such spring water combined with surface water cannot provide the endless supply of water needed for the expanded rice fields in the region. Nevertheless, it was noticed after 19 years of the project that “greenification” was taking place in the project area because of expanded rice production. The growing number of inhabitants in the area tended to plant trees around their houses and the expanded rice fields maintained grasses and trees around the area. Therefore, the current vegetation is a remarkable improvement upon the previous Savanna scenery.

It was not within the scope of the present evaluation to assess the changes of biodiversity. However, the Joint Evaluation Team was keenly aware of the need to undertake such studies separately in the near future, if rice production in Africa is to be extended on a larger scale.

Table 2-1

Table 1.

PROJECT DESIGN MATRIX (PDM) FOR KILIMANJARO AGRICULTURAL DEVELOPMENT PROJECT

Period of cooperation: March 1986—March 1993 Total of 7 years (FU 2 years)

Version: 24 March 97

Method for drafting: drafted by JICA at the time of evaluation

Donor's implementing agency: JICA

Partner Institution: Kilimanjaro Regional Government

Target Group: Personnel in KADC, extension staff, farmers in the project area

Narrative Summery	Verifiable indicators	Means of Verification	Important Assumptions
Higher Super Goal - The employment and household income in the Kilimanjaro region increased - Agricultural products in the Kilimanjaro region increased	- Number of jobs created & average household income in Kilimanjaro region - Agricultural production in Kilimanjaro region	1 Statistics of Kilimanjaro 2 Interviews with farmers	a. Government policy in support of rice production is maintained
Super Goal - Employment and the household income in the project area increased	- Employment generated & average household income in the project area	1 Statistics of K. Region 2 Interview with farmers	a. New water resources are secured in Kilimanjaro b. Farmers outside the project area practice paddy cultivation
Overall goal - Agricultural products in the project area increased	- Yields of rice, vegetables and maize in the project area	- Statistics of Kilimanjaro - Interviews with farmers	a. Price of agricultural products do not fall drastically
Project Purpose - Irrigation agriculture using modern farming techniques prevailed in the project area	- No. of farmers practicing irrigated paddy & horticulture farming with modern techniques and the farmland area - Farmer's level techniques	- Statistics of Kilimanjaro - Interviews with farmers	a. The climate does not change badly b. Abnormal outbreak of pests, disease and insects do not take place c. Necessary quantity of water for the project area is secured
Outputs 1 The system of project management is established 2 Training courses and curriculum in KADC are planned 3 The modules and training materials for training courses in KADC are prepared 4 Trainers of KADC are trained 5 Agricultural engineers and extension office are trained 6 Watermanagement engineers are trained 7 Appropriate varieties for paddy cultivation are identified 8 Appropriate varieties for horticulture are identified 9 Extension services for farmers in the project area are regularly provided 10 Agricultural machinery is properly maintained 11 Water- management is undertaken by farmers organizations	1 No. of staff, budget, manager's capacity level 2 Kinds and curricula of training courses conducted by KADC 3 Modules & teaching materials developed 4 No. of trained KADC trainers 5 No. of agricultural engineers and extension officers trained 6 No. of water management engineers trained 7 Appropriate rice varieties identified 8 Appropriate horticulture varieties identified 9 Frequency & quality of extension services provided 10 Utilization rate of machinery 11 Establishment and activities of watermanagement organizations	1 Record books, financial documents 2 Project reports 3 KADC training reports 4 Project reports 5 Project reports 6 O & M Office reports 7 Test cultivation reports 8 Test cultivation reports 9 KADC annual report, household survey of farmers 10 Household survey of farmers, lending records of the tractor lending agency 11 O & M Office reports	a. Agricultural machinery is hired by the farmers in the project area without difficulties

Activities	Inputs		
	Japanese Side	Tanzanian Side	a. The trained counterpart personnel remain in their jobs b. The construction of the mill (with capital grant aid) completed by March 1981
1-1 Secure staff at KADC and O&M Office according to the plan 1-2 Train managers 1-3 Draw up the budget and spend accordingly 1-4 Set up and manage the Joint Committee 2-1 Identify the training needs 2-2 Design the types and curricula for the training 3-1 Set up a committee to examine the modules and training materials 3-2 Develop modules for respective courses 3-3 Develop teaching materials for respective training courses 4-1 Appoint trainers for each field of training 4-2 Conduct orientation for trainers about curricula and training materials 4-3 Give technical guidance to trainers 4-4 Send selected trainers to participate in training in Japan 4-5 Manage the teaching materials properly 5-1 Conduct training courses at KADC for the technical staff & extension officers 5-2 Evaluate training courses 6-1 Train the watermanagement staff at O&M Office 6-2 Train the irrigation facility maintenance managers' at O&M Office 7-1 Introduce candidate rice varieties at KADC 7-2 Test cultivation of the candidate varieties of rice at KADC's trial plot 7-3 Test cultivation of the candidate varieties at the pilot farm 8-1 Introduce candidate varieties of upland crops at KADC 8-2 Test cultivation of the candidate varieties at the demonstration farm 8-3 Test cultivation of the upland crops at the demonstration farm 8-4 Demonstrate the selected variety of upland crops at the demonstration farm 9-1 Plan extension services for the farmers 9-2 Provide the extension services to the farmers 9-3 Evaluate the extension services 10-1 Give training to the staff of the tractor lending agency regularly 10-2 Advise the farmers on the maintenance of agricultural machinery regularly 11-1 Advise on the establishment of the farmers' water management cooperatives 11-2 Advise on the management of the farmers' water management cooperatives	Japanese experts: - 15 long-term experts in the following fields: (1) Team leader (2) Coordinator (3) Paddy cultivation (4) Upland cultivation (5) Water management (6) Agricultural machinery - 3 to 4 short-term experts annually in the following fields; soil analysis, agricultural economy, paddy diseases, agricultural machinery etc. Equipment: Vehicles, counterparts, office equipment etc., of the value of: 47,509,000 yen (FY 1986) 64,947,000 yen (FY 1987) 53,285,000 yen (FY 1988) 21,037,000 yen (FY 1989) 45,866,000 yen (FY 1990) 50,482,000 yen (FY 1991) Training in Japan: No. of participants: 3 people (FY 1986) 3 people (FY 1987) 3 people (FY 1988) 5 people (FY 1989) 1 person (FY 1990) 3 people (FY 1991) Support for local expenses: 82,109,000 yen in total	Building facility & land Trial plot Pilot farm Demonstration farm Staff - Project manager (Director KADC) - Counterpart personnel in the following fields to work directly with Japanese expert: (1) Paddy cultivation (2) Upland crop cultivation (3) Soil & water management (4) Development planning & water management (5) Agricultural machinery for paddy cultivation (6) Agricultural machinery maintenance - Administrative staff (clerks, accountants, support staff) Equipment As needed (other than that is granted) Project operation cost Salaries, expenses for training courses, expenses for building maintenance, electricity & water charges, etc.	Pre-conditions a. 1,100 hectares of paddy fields and 1,200 hectares of upland crop fields in the Lower Moshi area are consolidated by April 1987 b. O&M office for the irrigation facilities is established by December 1985

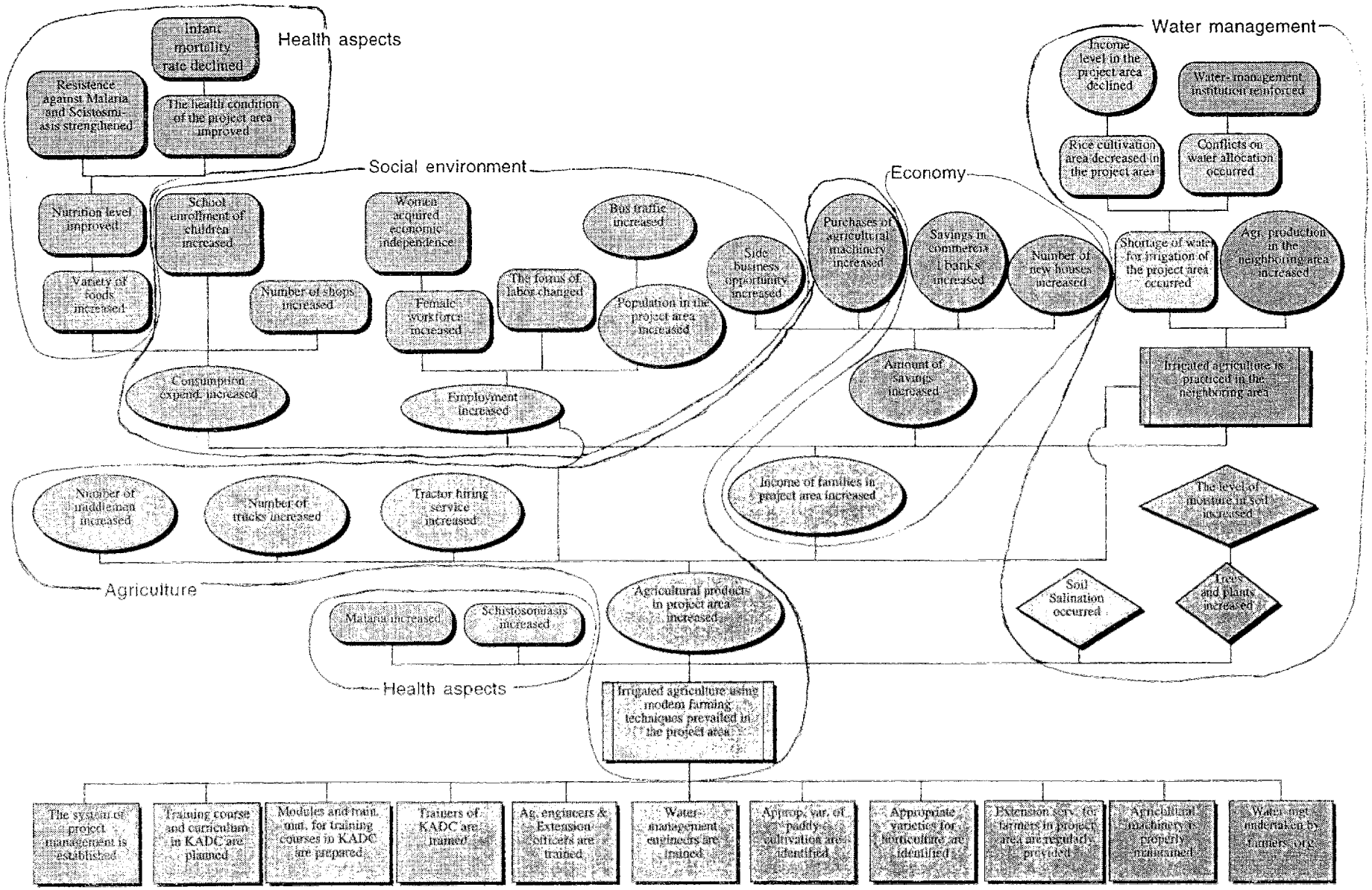


Chart 2-1 Impact Tree of the KADP Project

3 Outline of the KADP Project

3-1 Kilimanjaro IRDP and KADC

The Kilimanjaro region is located in the northern part of Tanzania bordering Kenya. It covers an area of 13,209km^2, or 1.4% of the national land, and has a population of 1.27 million people which, according to the 1995 estimate, is 5% of the national population. The highland zone (between 1,100 and 1,800 meters above sea level), where annual rainfall is between 1,250 and 2,000 mm, has the highest population density at 650 people per sq. kilometer. The intermediate zone (between 900 and 1,100 meters above sea level), where annual rainfall is between 800 and 1,250 mm, has the second highest population density at 250 people per sq. kilometer. The people rely mostly on agriculture. These two zones are extensively and intensively cultivated and can hardly accommodate further population increases, and neither can they expand the available cultivable land. The agricultural development project in the Lower Moshi area was therefore a significant policy priority in examining the expansion of new cultivable land and inducing migration.

In 1978, Kilimanjaro drew up its Integrated Regional Development Plan (IRDP) with the support of the Government of Japan. In that partnership, the two Governments agreed to concentrate on cooperation in the fields of irrigated agriculture development, small-scale industrial development, rural electrification, and water resource studies in the Kilimanjaro region.

The following irrigated agricultural development projects were concentrated in the Lower Moshi area of 2,300 ha:

(1) Kilimanjaro Agricultural Development Centre (KADC) (technical cooperation)
(2) Construction of KADC buildings and facilities (capital grant aid). The head office in Moshi town and field offices in Chekereni, Moshi Rural District, were completed in 1981.
(3) Construction of Lower Moshi Irrigation Project (2,300 ha) (yen loan): 1,100 ha for rice paddy field and 1,200 ha for upland field, with irrigation facilities, were completed in 1987.

(4) Tractor Hire Service (grant aid for increased food production): 292 units of tractors and their implements were provided.

In addition to the above, the Rural Electrification Project (yen loan) was also extended to cover the establishment of an electric transmission line from Moshi Town to the KADC Project site (about 8 km), which made the Center function properly without lack of electric power.

KADC was implemented for seven years from 1978 to 1986, assisted by JICA's technical cooperation scheme. The purpose of KADC was to ensure that appropriate rice farming techniques supported by an irrigation system were commonly practiced and firmly established in the Lower Moshi Project area through the following activities:

(1) Provision of technical advisory services on water resource development
(2) Agricultural experiments on cultivation of rice and upland crops at the trial and pilot farms
(3) Extension of improved farming methods on the pilot farm involving farmers
(4) Training of local counterparts, extension officers and farmers in the fields of rice cultivation, upland crop cultivation, water management and agricultural machinery

In the course of implementation of KADC, it was reported that the water available to the project site was less than had been expected. Consequently, the original plan of paddy cultivation with double cropping on 2,000 ha was amended for execution on 1,100 ha. A total of 10 long-term experts and another 10 short-term experts were assigned to KADC for seven and half years. Sixteen Tanzanian counterparts were trained in Japan and machinery and equipment amounting to 250 million yen were provided to the Center. Further, 257 Tanzanian extension officers and farmers were trained.

As a result of testing rice varieties on the trial and pilot farms, some varieties including IR54 proved to be as suitable to the area.

3-2 Kilimanjaro Agricultural Development Project (KADP)

The Kilimanjaro Agricultural Development Project (KADP) commenced as the second phase of KADC in 1986 and ended in 1993. (KADC remained as an organization in KADP. See Chart 5-1) There was a follow-up period of another two years up to 1995. Since then, two experts have been attached to the project to provide continuing technical advice. KADP aimed at furthering the objectives of KADC in the promotion of agricultural development of the Lower Moshi area by extending JICA's technical advice for the region's agricultural endeavors. The major activities covered the following fields:

(1) Within the Lower Moshi Project area

① Selection of appropriate rice varieties, establishment of scientific agricultural methods, their exhibition, dissemination, and the training of people concerned

② Establishment of horticulture methods, exhibition, dissemination, and training of people concerned

③ Establishment of water management technology, its dissemination and training to people concerned, and the provision of technical advisory services on the maintenance of irrigation facilities

④ Adaptability test of various agricultural technologies, the provision of technical advisory services, and training of the people concerned on the operation and maintenance of agricultural machinery

(2) Within Kilimanjaro region

⑤ Providing technical advice on agricultural development in the region.

During the seven years of cooperation, 15 long-term experts and 6 short-term experts were assigned to the Kilimanjaro region. Machinery and equipment amounting to 240 million yen was provided. Eighteen Tanzanians were trained in Japan and one in Egypt. In addition, from 1986 to 1990, 292 extension officers, 242 farmers and 247 tractor and agricultural machinery operators and supervisors were trained, bringing the number of trainees to a total of 781.

In addition to the above aspects of technical cooperation, the following inputs were provided and completed through different aid schemes:

① 35 unit of tractors and spare parts were provided to strengthen the tractor hire services, and to increase food production.

② In 1987, the Lower MoshI Irrigation Project of 2,300 ha was completed.

③ A rice mill was completed in 1989 with funds provided through capital grant aid.

④ Ndungu Irrigation Project in the same region (680 ha) was also completed in 1990 with funds provided through capital grant aid.

To complement Japanese assistance, the Tanzanian side also made corresponding efforts for KADP by providing TS 45,000,000 as counterpart funds in addition to about 200 persons who were employed in project-related activities in the 1990 peak period.

Through a series of experimental tests, it was discovered that although Japonica type rice showed a high tolerance to cold temperature, it was not suitable to the Kilimanjaro region due to its difficulties in threshing. IR54 showed higher yield/per hectare and easy threshing and was consequently disseminated in the project area. However, it was considered beneficial to select a rice variety with stronger resistance to cold temperatures, since IR54 has a 140-day maturation period in comparison with an ideal period of 120 days.

The total amount of water available from Njoro River and Rau River was found to be insufficient to irrigate 1,100 ha during the wet season and 800 ha during the dry season. Consequently a three cropping method was adopted in 1988, by which actual cultivation has increased to 1,625 ha, producing 10,660 tons at its peak and earnings of about TS 472,000,000.

Since then, however, the water shortage became much more acute in the project area due to water usage in the upper end of the river where neighboring farmers outside the project had their rice farms. As a result, the actual cultivable land in the project area gradually declined, as did the amount of rice produced.

Today, the issue of water shortage remains unsolved, and upland agriculture is accorded less priority as the region is more focused on improving the cultivation of beans

and vegetables during the wet season. For this reason, this evaluation gave particular attention to rice production in KADP.

4 Impacts

4-1 Economic Aspects

4-1-1 Increase of farmers income

(1) Farmers increased their net income by six times

Over a period of seven years from 1978 to 1986, the Kilimanjaro Agricultural Development Center (KADC), using a 10ha trial farm and 100ha pilot farm, trained farmers and counterparts, produced appropriate seeding varieties, developed effective irrigation systems, cultivated for verification, extended technology to farmers, and provided useful information on machinery, etc.

In May 1984, irrigation construction began on 2,300 ha of farmland in the Lower Moshi area, using the Rau river and Njoro spring as water sources. Construction was completed in April 1987. This included 1,107 ha of rice paddies and 1,193 ha of fields (2,300 ha total) as well as facilities for drawing water, irrigation, drainage, walking between fields, and flood prevention.

A number of farmers were skeptical of irrigated rice cultivation when KADC training began. However, when the first 70 ha of construction were completed in the Upper Mabogini area and the farmer's first rice yields reached more than 7 tons/ha (some 3-4 times more than traditional yields), their attitudes quickly changed and they began to put their utmost efforts into rice cultivation. Irrigated rice cultivation under the project rapidly picked up pace.

As a result, the increased rice production in the region from 1985 to 1995 (see Table 4-1) brought large increases in the incomes of farmers as prices rose. Rice yields in the Lower Moshi area reached a peak of 13.5 times traditional yields in 1990 and 8 times in the final year of KADP (1993). The farmers treated rice as a cash crop, limiting the amount used for personal consumption and selling the majority. If the entire yields were sold, this would amount to an astronomical increase in the income from rice cultivation. In 1992, nominal income would have been 56.3 times the traditional rice income. In 1993, the increase would have been 53.4 times. While consumer prices increased 6.05 times from 1985 to 1992 and 7.58 times in 1993, the total net income of rice farmers is estimated to have increased 9.3 times in 1992 and 7.0 times in 1993. However, since household consumption was also evident (10-20%), KADP estimated the actual net income of farmers from rice cultivation increased by about six times.

Table 4-1 Paddy Cultivation Area, Production and Estimated Gross Income At KADP Lower Moshi Project (1985-1996)

Year	Season	Cultivated area (ha)	Average paddy yield (t/ha)	Estimated paddy production from cultivated area (t)	Paddy price (Tsh/kg)	Estimated gross income (Tsh)
1985		112.42	7.02	789.19	15.00	11,837,850.00
1986	Rain s.	138.02	7.59	1,047.57	19.00	19,903,830.00
	Dry s.	491.87	6.49	3,192.24	20.00	63,844,800.00
	Total	629.89		4,239.81		83,748,630.00
1987	Rain s.	432.34	6.70	2,896.78	27.00	78,213,060.00
	Dry s.	490.64	6.69	3,282.38	27.50	90,265,450.00
	Total	922.98		6,179.16		168,478,510.00
1988	1st s.	450.50	7.19	3,239.10	30.00	97,173,000.00
	2nd s.	461.69	5.69	2,626.59	30.00	78,797,700.00
	3rd s.	410.33	6.14	2,519.43	30.00	75,582,900.00
	Total	1,322.52		8,385.12		251,553,600.00
1989	1st s.	598.37	4.60	2,752.50	30.00	82,575,000.00
	2nd s.	535.33	6.18	3,308.39	33.00	109,176,870.00
	3rd s.	418.77	5.68	2,378.61	35.00	83,251,350.00
	Total	1,552.47		8,439.50		275,003,220.00
1990	1st s.	630.47	5.47	3,448.71	40.00	137,948,400.00
	2nd s.	571.21	8.44	4,821.01	46.00	221,766,460.00
	3rd s.	423.79	5.64	2,390.18	47.00	112,338,460.00
	Total	1,625.47		10,659.90		472,053,320.00
1991	1st s.	351.36	7.11	2,498.17	50.00	124,908,500.00
	2nd s.	402.04	6.10	2,452.44	80.00	196,195,200.00
	3rd s.	419.82	7.30	3,064.69	87.50	268,160,375.00
	Total	1,173.22		8,015.30		589,264,075.00
1992	1st s.	No cultivation due to water shortage				
	2nd s.	456.09	7.90	3,603.11	87.50	315,272,125.00
	3rd s.	453.88	7.75	3,517.57	100.00	351,757,000.00
	Total	909.97		7,120.68		667,029,125.00
1993	1st s.	337.08	6.30	2,123.60	94.00	199,618,400.00
	2nd s.	392.80	5.90	2,317.52	106.00	245,657,120.00
	3rd s.	279.20	6.70	1,870.64	100.00	187,064,000.00
	Total	1,009.08		6,311.76		632,339,520.00
1994	1st s.	No cultivation due to water shortage				
	2nd s.	427.85	5.30	2,267.61	110.00	249,437,100.00
	3rd s.	224.27	6.80	1,525.04	125.00	190,630,000.00
	Total	652.12		3,792.65		440,067,100.00
1995	1st s.	No cultivation due to water shortage				
	2nd s.	292.29	6.20	1,812.20	150.00	271,830,000.00
	3rd s.	175.73	6.10	1,071.95	162.50	174,191,875.00
	Total	468.02		2,884.15		446,021,875.00
1996	1st s.	242.64	5.40	1,310.26	175.00	229,295,500.00
	2nd s.	313.24	7.10	2,224.00	175.00	389,200,000.00
	3rd s.	278.28	6.60	1,836.65	175.00	321,413,750.00
	Total	834.16		5,370.91		939,909,250.00

Source: KADP

(2) Profitability of farms increased drastically for rice production

The profitability per farm has dramatically increased because of the irrigated rice production. The following four examples from the survey (refer to Table 4-2) and verification illustrate this phenomenon:

① Farmer A (rice grower in the project area)
Chekereni Village; 1.5 plots (0.45 ha) yielded 2.0 tons (4.4 t/ha). Cost of equipment was Tsh 350,000. Net profit was Tsh. 150,850 (sold 20 bags out of 25 bags harvested), hence profitability per hectare was Tsh 490,778.

② Farmer B (rice grower in the project area)
Rau River Village; 1 plot (0.3 ha) yielded 1.8 tons (6.1 t/ha) which was equivalent to Tsh 322,000. Profit was Tsh 220,900 (sold all), hence profitability per hectare was Tsh 736,333.

③ Farmer C (rice grower outside the project area)
Mandaka Village; 3 acres yielded 6.5 tons (5.4 t/ha) which was equivalent to Tsh 810,000. Net profit was Tsh 354,300 (sold 76 bags out of 81 bags harvested), hence profitability per hectare was Tsh 336,917.

④ Farmer D (maize grower)
Rau River Village; 2 acres yielded 2.6 tons (3.2 t/ha) which was equivalent to Tsh 288,000. Net profit was Tsh 152,200 (sold 22 bags out of 32 bags harvested, hence profitability per hectare was Tsh 302,750). Farmer D produces maize only and his yield (3.2 t/ha) is much higher than the average yield in the region (1.7 t/ha). Even with this situation, the profitability is lower than the three rice producers, as shown above. Since maize is the staple food in the area, most farmers grow it regardless of its profitability.

(3) Non-farm income increased

According to the farmers surveyed, a large percentage of farmers operate other businesses in addition to agriculture. Some of the popular businesses include: mbegi bars (home brew), small shops selling basic items, sewing machines for tailoring, and small-scale milling. There are also many farmers outside the project area providing labor to farmers inside the Project. It is interesting to note that prior to the establishment of this project there were not many business opportunities in the area. Only since the

Table 4-2 SUMMARY of INTERVIEW (agricultural aspect) to FARMERS

	1 (A)			2		3		4		5	6		7		8 (B)		9 (D)
Name	Ms. Theresia Maria			Ms. Atanasia Steven		Mr. Sinom Mwanga		Mr. January John		Mr. E. Kairani	Mr. Zacaria Mumburi		Mr. Nathaniel Msuya		Mr. Juma Seif		Mr. W. Josib
Place	Chekereni			Chekereni		Chekereni		Chekereni		Chekereni	Rau Ya Kati		Rau Ya Kati		Rau Ya Kati		Rau Ya Kati
Major crop	Rice	Maize	Beans	Rice	Maize, beans, sunflower, F.millet	Rice	Maize, Beans	Rice	Maize, Beans, F.millet	Maize	Rice	Maize, Beans, Sunflower	Rice	Maize, Beans, Sugarcane	Rice	Maize, Soybean	Maize
Area (ha)	0.45	0.8	0.45	0.54	0.4, 0.1, 0.2, 0.2	0.15	0.4 0.1	0.3	0.4, 0.2, 0.2	0.8	0.48	1.6, (1.6), 0.4	0.45	2.4, 1.2, 1.2	0.3	1.6, 0.2	0.8
Variety	IR54	Local	Local	IR54		IR54		IR54	CG-4141, Local	Local	IR54		IR54		IR54	Local	CG4141
Season	Jan-May	Mar-Aug	May-Aug	May-Sep	Mar-Aug	Jan-May	Mar-Sep	May-Sep	Mar-Aug	May-Sep	May-Sep	Mar-Aug	May-Sep	Mar-Aug	May-Sep	May-Sep	May-Sep
Yield (t/ha)	4	1.8	0.53	2.4	1.2, 0.6, 1.0, 0.25	5.6	1.05, 0.9	4	1.4, 2.0, 0.8	0.7	5.8	0.56, 0.04, 1.2	5.5	0.33, 0.03	6.1	1.85, 0.5	3.2
Total (bag=80kg)	25	18	3	16	6, 0.6, 4, 1	12		15	7, 5, 2	7	35	11.3, 0.75, 6	31	10, 0.5	23	37, 1.25	32
Equivalent value (Tsh)	350,000	243,000	75,000	208,000		144,000		210,000			299,985		434,000		322,000		288,000
Sold Q'ty (bag=80kg)	20	8	2	7		5		10			26		30		23		22
Sold Price (Tsh/bag)	14,000	13,500	25,000	13,000		12,000		14,000			8,571		14,000		14,000		9,000
Sold value (Tsh)	280,000	108,000	50,000	91,000		60,000		140,000			224,989		420,000		322,000		198,000
Home use & storage (bag)	5	10	1	9	6, 0.6, 4, 1	7	6, 11	5	7, 6, 2		9	11.3, 0.75, 6	1	10, 0.6			10
Land rent													52,500				
Hired Labor																	
Land preparation	6,000							3,500									
Nursery	2,500														3,000		
Transplanting	22,500			20,000		5,000		11,000			15,000		20,000		18,000		4,000
Weeding	21,000			35,000				8,000					16,000		4,000		6,000
Harvesting	25,000			32,000		6,000		9,000			12,000		27,900		16,100		6,400
Bird scaring															7,000		
Input																	
Seed								3,500									
Urea	17,250			11,000		11,000	11,000	16,500			22,000	11,000	33,000		11,000		15,400
A.sulfate		6,000		7,000				10,500			7,000		21,000		14,000		
TSP	12,500			7,500		3,125											
Insecticide	4,400			9,000		9,000		3,000			9,000		2,500	9,000	2,000		
Machine rent																	14,000
Chawampu fee	18,000			23,000		11,500		19,000			23,000		26,000		26,000		
Other fee						5,000											
Total expense	129,150	6,000	0	144,500		50,625	11,000	84,000			88,000	11,000	198,900	9,000	101,100		45,800
Income from crops	150,850	102,000	50,000	-53,500		9,375		56,000			136,989		221,100		220,900		152,200
Profitability (Tsh/ha)	490,778	296,250	166,667	117,593		622,500		420,000			441,635		622,444		736,333		302,750
Rate of profit (%)	63	98	100	31		65		60			71		54		69		84
Agent of techniques	Extension			Extension		Extension		Extension			Extension		Neighbor		Neighbor		
Credit				Friends							Friends						Friends
Income from livestock (Tsh)	1,780,000																
Total net farm-income (Tsh)	2,082,850			-53,500		1,625		56,000			125,989		212,100		220,900		152,200
Non-farm																	
Income source				Mbege bar (home brew)		Small shop				Farm labor			Brown sugar		Small shop		Small shop
Income				150,000		?				?			500,000		120,000		360,000
Remarks				0				Used to rent a plot at			Rented a plot last year at				Started rice		
				one plot rented out				40000Tsh/plot for extra			40000 Tsh/plot				cultivation "91		

Table 4-2 (continued) SUMMARY of INTERVIEW (agricultural aspect) to FARMERS

	10	11		12	13 (C)		14	15				16	17		18		
Name	Mr. V. Angasio	Ms. D. Rasaro		Mr. B. Abrahame	Mr. H. Satim		Ms. R Mushi	Mr. H. Hemedi				Mr. D. Masaga	Mr. I. Mibel		Ms. R. Sangawa		
Place	Rau Ya Kat	Mandaka		Mandaka	Mandaka		Mandaka	Chekerai Waruweri				Chekereni W.	Chekereni W.		Chekereni W.		
Major crop	Maize	Rice	Maize	Rice	Rice	Maize	Rice	Rice	Maize	Ground nut	Bean	Maize	Rice	Maize	Rice	Ground nut	Maize, Bean
Area (ha)	0.4	1.2	0.8	0.4	1.2	2.4	0.2	0.8	1.2	0.8	0.5	1.2	0.4	0.8	0.4	0.1	1.2, 0.1
Variety	Local	IR54	CG4141	IR54	IR54	CG4141	IR54	IR54	CG4141	Local	Local	CG4141	IR54	CG4141	IR54	Local	CG4141, Local
Season	May-Sep	Mar-Aug	Mar-Aug	Mar-Aug	Mar-Sep	Mar-Aug	Oct-Mar	Jun-Oct	Mar-Aug	Mar-Aug	Apr-Aug	Mar-Aug	Mar-Sep	Mar-Aug	Mar-Sep	Mar-Aug	Mar-Agu
Yield (t/ha)	0.63	5.5	1.8	5	5.4	2	4	7.6	5	2.6	1.76	1.6	2	1.5	1.6	2.4	2, 0.8
Total (bag=80kg)	3.1	83	18	25	81	60	10	76	60	26	11	24	10	15	8	3	30, 1
Equivalent value (Tsh)		830,000	162,000	325,000	810,000	540,000	90,000	912,000	720,000	390,000	275,000	240,000	100,000	150,000	80,000	30,000	
Sold Q'ty (bag=80kg)		83	8	8	76	50	10	73	57	26	10	19	4	2	5	3	
Sold price (Tsh/bag)		10,000	9,000	13,000	10,000	9,000	9,000	12,000	12,000	15,000	25,000	10,000	10,000	10,000	10,000	10,000	
Sold value (Tsh)		830,000	72,000	104,000	760,000	450,000	90,000	876,000	684,000	390,000	250,000	190,000	40,000	20,000	50,000	30,000	
Home use & storage (bag)			10	17	5	10		3	3	0	1	5	6	13	3		30, 1
Land rent		105,000		50,000			35,000						15,000				
Hired Labor																	
Land preparation		150,000		20,000	60,000		19,000	64,000				21,000	18,000		10,000		
Nursery																	
Transplanting		84,000		15,000	54,000			28,000	12,000	8,000	5,000	15,000	7,000		4,000		12,000
Weeding		60,000		6,000	45,000	72,000		16,000	24,000	16,000	10,000	30,000		10,000			
Harvesting		83,000		17,500	56,700	42,000		36,000	24,000	16,000	10,000	15,000					
Bird scaring				15,000	12,000			30,000					10,000				
Input																	
Seed						30,000			30,000			36,000					
Urea		49,600		165,000	99,000	66,000	8,260	22,000	16,500			33,000	11,000		11,000		
A.sulfate		31,500		10,500			5,350	14,000					7,000				
TSP																	
Insecticide					27,000		4,800	20,500					10,000		8,500		
Machine rent						60,000			24,000	16,000	10,000						35,000
Chawampu fee					52,000												
Other fee																	
Total expense		563,000	0	160,500	406,700	270,000	72,300	240,500	130,500	56,000	35,000	150,000	78,000	10,000	33,500	0	47,000
Profit from crops		267,000	72,000	-46,500	354,300	180,000	17,700	635,500	563,500	334,000	215,000	40,000	-38,000	10,000	16,500	30,000	
Profitability (Tsh/ha)		222,500	202,500	436,250	336,917	112,600	88,500	839,375	491,250	417,500	480,000	75,000	55,000	175,000	116,250	30,000	
Rate of profit (%)		32	100	54	50	50	20	74	82	86	87	38	32	93	58	1,000	
Agent of techniques		Neighbor			Neighbor		Neighbor	Neighbor					Neighbor		Extension		
Credit		Friends		Friends	Friends		Friends	Friends					Friends		Friends		
Income from livestock (Tsh)		54,000					300,000										
Total net farm-income (Tsh)		393,000		-46,500	534,300		317,700	1,738,000				40,000	-28,000		-500		
Non-farm																	
Income source	Petty business			Farm work				Bar				Frame work	Frame work				
Income	?			?				?				?	?				
Remarks					Village chief		Poultry farm										
							100 chickens										

profitability of irrigated rice production was demonstrated, have the local farmers felt comfortable in expanding their business interests.

(4) The rate of increase in income from rice production dropped in the project area.

Rice cultivation in neighboring villages began to increase from 1994, resulting in an increase in the amount of water intake in the upper part of the river. As a result, the amount of water available in the project area dropped dramatically. Rice yields decreased from one-half to one-third of peak levels. Despite rice price increases, the net increase in income in 1994 rapidly fell to 3.65 times the traditional income levels.

However, the project had far-reaching impact throughout the Kilimanjaro region and the total area under irrigated rice cultivation increased 2.26 times from 1985 to 1993 (10,015 ha) and 2.14 times in 1994 (9,458 ha). It is estimated that the rice farmer's income in the whole region increased 12.4 times in nominal terms and 1.6 times in real terms in 1993, and 17.6 times in nominal terms and 1.7 times in net terms in 1994.

4-1-2 Increase of Rice farmers consumption

(1) Rice farmers built new houses.

According to the household survey conducted by Toshitaka Katsuki in 1991, a short-term expert, 79 out of 81 households (98%) replied that their living conditions were improved in comparison with those before the project (see Table 4-3). Increase in the income of the rice farmer affected the consumption trends, most evidently. The biggest change was the increase in new houses. It is generally said that the Chaga people, the majority ethnic group in the Kilimanjaro region, build houses when their income increases, and this was evident in the Lower Moshi project area, where many new houses with block walls and tin roofs appeared in various villages. Before the project began in the middle of the 1980s, most of the houses in the area were small huts with mud walls and grass roofs. The fact that many of these were turned into splendid houses indicates that the project has given great impact on the farmer's income.

(2) Living standard of rice farmers was greatly improved.

Increased consumption as a result of increased income brought about an improved standard of living. In the same survey conducted by Kozuki, 81 household replied positively about the changes: Transportation 100%, Meals 93%, Education 78%, Housing

74% Criminals 67%. One indicator of the improved standard of living is the electrification of households. The number of households receiving electricity in the Kilimanjaro region increased 4.6 times over 12 years, from 7,556 in 1983 to 35,051 in 1995 largely due to grant aid for the power distribution project. In Lower Moshi, the number of households receiving electricity increased 45 times, from 3 in 1984 to 134 in 1995. Consumption of electricity is accelerated by the purchase of household electronic appliances. Purchases of radio-cassettes, television sets, sewing machines, refrigerators, and electric cookers increased steadily, especially in the Lower Moshi area.

Table 4-3 Farmers' feelings on their living standards in Lower Moshi Irrigation Project

Area (Village)	No. of farmers interviewed	Living standard (1987)			Living standard (1991)		
		Improved	Deteriorated	Others	Improved	Deteriorated	Others
Upper Mabogini	26	14	10	2	24	1	1
Lower Mabogini	13	8	5	0	13	0	0
Rau ya Kati	18	11	6	1	18	0	0
Chekereni	24	20	4	0	24	0	0
Total	81 (100%)	53 (65%)	25 (31%)	3 (4%)	79 (98%)	1 (1%)	1 (1%)

Note: Question for 1987 was "Compared to 10 years ago, your living standard is improved or .....?"

Question for 1991 was "Compared to before starting the project, your living standard is .....?"

Source:

Toshitaka KATSUKI, 1993, Change of Farm-household Economy under KADP in Tanzania (2), Agricultural Research Institute.

4-1-3 Increase of Employment

(1) Over one thousand employment opportunities were newly created.

According to a calculation by KADP, there were approximately 70 workers employed in a day per plot of farmland (0.3 ha). This is equivalent to 231 workers a day per hectare and 254,100 workers per 1,100 ha. This leads to some 1,104 workers a year per 1,100 ha.

The actual amount of land cultivated in the project area (1,100 ha) reached a peak of 1,525.5 ha in 1990. In employment terms, this is equivalent to 1,532 workers a year. In 1993, the actual amount of land cultivated reached 1,009.08 ha, or 1,013 workers a year.

(2) Over five thousand employment opportunities were newly created in the region

The amount of land cultivated outside the project increased dramatically, as did the number of waged laborers. Assuming 100 percent wage cultivation for a cultivated land area of 10,015 ha in 1993, the estimated amount of employment reached 10,058 workers. Even if the waged cultivation ratio were only 50 percent, there would still have been an employment increase of more than 5,000 workers. This increase of employment is resulting in population increase in Lower Moshi. It is said that decrease in the number of crimes is attributed to the increase of employment.

At the rice mill, a total of 37 were employed, including 25 regular employees, 7 wage laborers and 5 security personnel. Another 15 workers were employed at the CHAWAMPU rice farmers cooperative. Inside and outside the Lower Moshi project, small sundry shops and sewing shops are beginning to appear, and investments in other non-farming industries, while limited, are also appearing. There is an increasing number of students registered at the junior high school level and other higher education, which created a number of sewing jobs related to school uniforms. Thus the expansion of education opportunities and booming of retail and service businesses are creating secondary employment opportunities in the region.

4-1-4 Food supply effects

(1) Rice production in Kilimanjaro contributed to increased food supply in Tanzania

Rice production in Kilimanjaro increased 2.7 times to 30,845 tons from 1983 to 1995, contributing to the increased rice yield of the country as a whole. About half of this rice was consumed within the region and another half outside the region. Most of the rice is harvested and sold directly to brokers, but some is polished at a rice mill before being sold. The brokers come from Arusha and there are 10-12 of them in all. Several female farmers serve as agents for these brokers. Two of the farmers (one male, one female) act as independent brokers, selling mainly to larger brokers from Arusha and in local markets.

(2) Consumption of rice as staple food is getting habitual among people

Nowadays, in the urban areas of Kilimanjaro, people generally eat rice every day. In rural areas, people have traditionally eaten rice only several times a year during special events, but are now starting to eat rice several times a week. The increase in

consumption can be attributed to the lower price of rice compared with bread, the ease of preparation compared with Ugari (traditional food staple), and the popularity of rice among children.

4-1-5 Demonstration of effects in other provinces

(1) The positive impacts of rice production are being disseminated to other provinces

KADP has attracted the attention of other regions in Tanzania and many observers have paid visits. The visitors were inspired by their observations of the farmers because they produced the rice themselves, made great profits and built new houses. By FY1996, governors of five regions visited the KADP site and thereafter made requests for similar cooperation to the Japanese embassy. Current training at the Kilimanjaro Agricultural Training Center (KATC) covers rice growing, water management, tractor operation, and the mechanization of rice growing, among other techniques related to irrigated rice cultivation accumulated under KADP. A key farmer's training course is also being offered. Most of the participants come from other regions in Tanzania, where the dissemination of rice growing technology within KADP and Kilimanjaro as well as the benefits to farmers are well known. From August 1995 to February 1997, a total of 17 courses were organized with 333 participants from 16 regions. The key farmer's course is considered an especially important training course. Under this course, extension workers and key farmers from the same region undergo training together. By visiting KADP farmers, discussing relevant matters and seeing things with their own eyes, this training is an important opportunity for all the farmers who take part in. The effect of demonstrations given to other regions is difficult to grasp in quantitative terms, but they are expectedto lead to an expansion in the amount of land under cultivation and an increase in rice yields.

4-2 Impact upon Regional Agriculture and Farmers

4-2-1 Increase in rice production

(1) Total paddy rice production dramatically increased.

Chart 4-1 shows that as paddy production in the Lower Moshi Project area steadily increased through 1990/91, regional rice production as a whole increased remarkably after 1988. After 1991/92, the situation also changed in such a way that while paddies in the project area gradually decreased, due to the shortage of water, those in outside areas

Chart 2

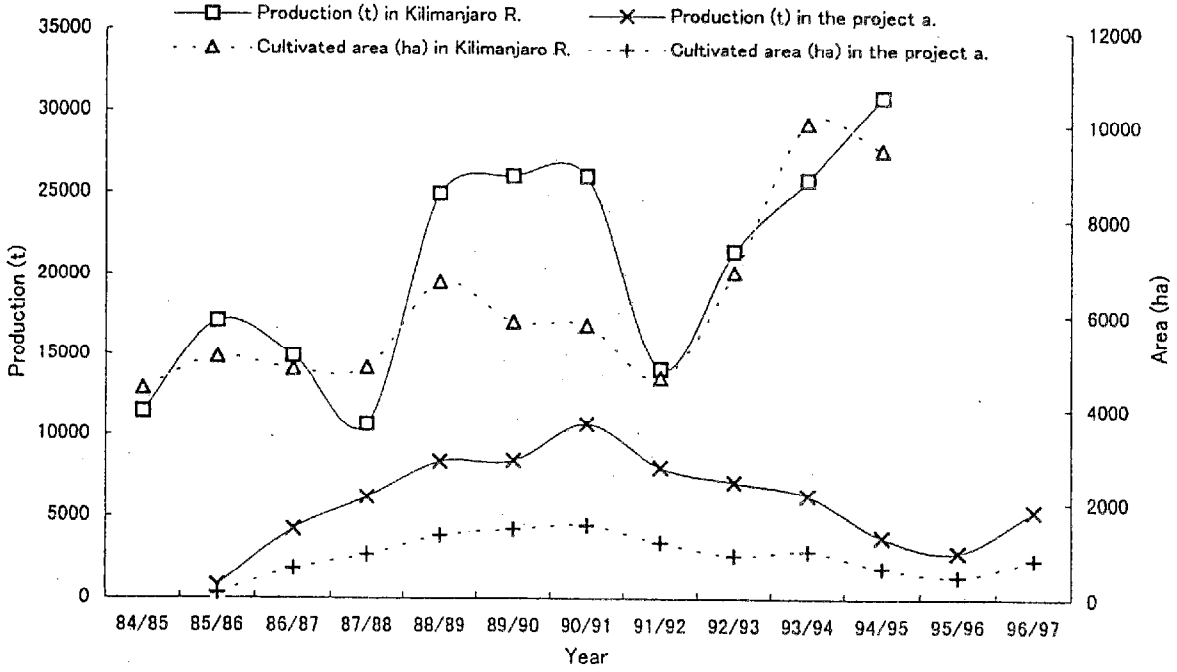


Chart 4-1 Paddy production and cultivated area in the Kilimanjaro region and the project area
(Source; KADP & Regional planning office of Kilimanjaro)

Chart 3

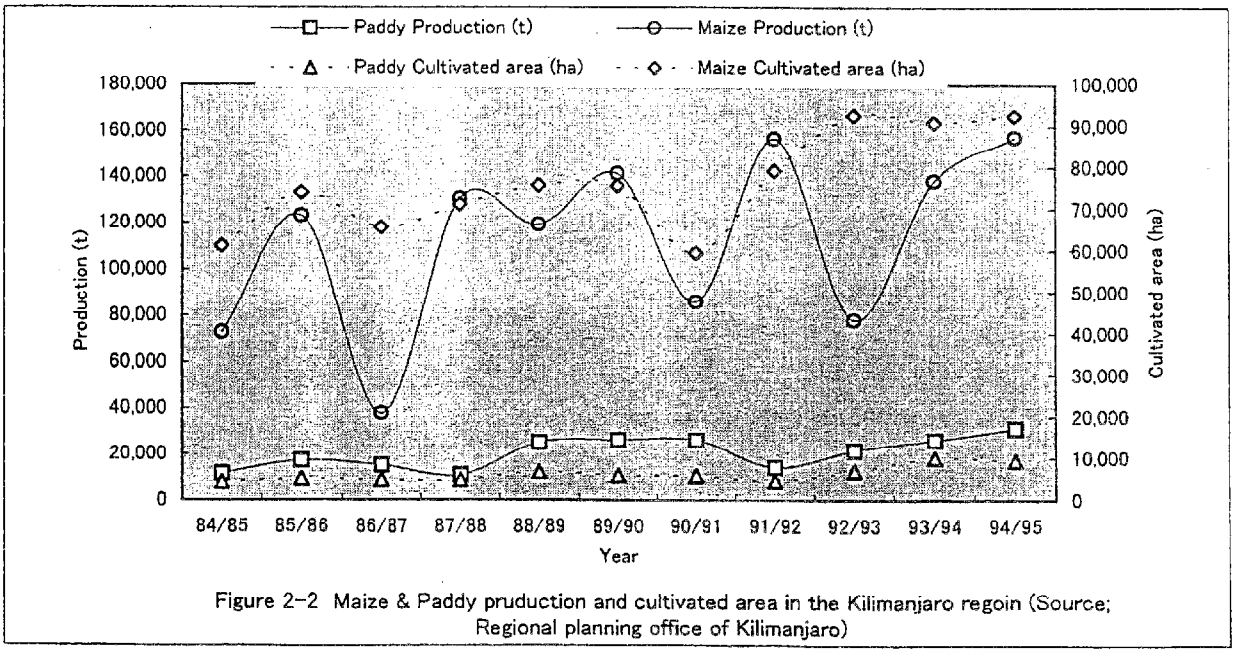


Figure 2-2 Maize & Paddy pruduction and cultivated area in the Kilimanjaro regoin (Source; Regional planning office of Kilimanjaro)

Chart 4-2 Maize & Paddy production and cultivated area in the Kilimanjaro region
(Source; KADP & Regional planning office of Kilimanjaro)

sharply increased. It is apparent that the gap in the amount of rice production is widening between the areas inside and outside the project area, which implies that rice production is spreading throughout the region very quickly.

Chart 4-2 compares the production of maize and rice in the kilimanjaro region.. In general, both crops have been increasing over time and there is no clear tradeoff between the two.

(2) Regional cropping pattern has been changed

The major change in the regional cropping pattern is the shift to irrigated rice production from upland crops or rain-fed rice production. This change has taken place due to the profitability of cultivating paddies. Within the project area, farmers carried out double cropping for several years, but this is no longer possible due to the water shortage mentioned above. At present, the farmers are adopting a three crop rotation pattern, ie. rice/maize or beans/rice. These crops are supplemented by traditional crops such as vegetables, bananas, sunflowers and spices.

4-2-2 Dissemination of Technology and Extension Services

(1) The most modern irrigated rice production technology took root.

The most modern irrigated rice production technology has been applied to the Lower Moshi Project area. According to all of the data reviewed, everything from detailed soil analysis to time of planting was researched specifically for this area. One new technique to this area was the planting of seedlings in orderly rows of a specific length. Fertilizer application methods were taught throughout the scheme in order to realize the maximum benefit. With these new technologies, the farmers were Chart 2, 3

able to produce yields of over 6 tons per hectare, as opposed to 2 tons per hectare prior to the technology being delivered. These yields cover more than the costs associated with the additional inputs, thus increasing the profitability per farm.

(2) Modern technology was well transferred to farmers

Within the project area, farmers are regularly served by the KADP extension staff. This is done by means of training and visits by the officers, then it usually spreads by word of mouth between farmers. There are field seminars where the various techniques required to obtain maximum yields are demonstrated. Topics include fertilization, plant-

ing and harvest timing as well as the safe utilization of pesticides. It was found in the survey, that all of the farmers within the project area and many outside the project area took advantage of these services. People in the district generally regard the transfer of such technology as extremely valuable. One example of the adoption of the new technology is the farmer's acceptance of the high yielding variety IR 54, which was researched and subsequently disseminated by KADP staff. It is now estimated that this variety is produced on up to 11,450 ha of land. This is impressive when one considers that ten years ago the total area of rice production, using traditional varieties, was approximately 4,000 ha.

4-2-3 Support Services

(1) Rice Milling Center is in competition with small mills.

This milling center is a vital link in the overall success of KADP. Without it, the project would not have been as profitable to individual farmers as it is at present. One of the spin-offs of the dissemination of paddy technology is the growth in small milling operations. These small businesses offer both rice and maize milling but generally of a much lower quality than the central rice mill. The overall effect of these small mills is to force the central mill to operate at a level far below its capacity. On the other hand, when the expansion takes place, the large rice mill will be invaluable.

(2) Access to on formal credit facilities by rice farmers in Lower Moshi are limited.

Agricultural credit exists, but the quantity is difficult to determine because the lender is often a family member or a friend. The usual transaction is to borrow at planting time for inputs and repay the loan after selling the crop. There is a District Cooperative Office which operates both savings and loan functions. Despite the fact that there are 55 offices offering an interest rate of approximately 25%, the Lower Moshi farmers prefer to deal with family and friends. The national banks charge 41% and are not generally utilized by the farmers.

4-2-4 Marketing

(1) Farmers relied on middleman/woman for marketing

Virtually all of the farmers surveyed took advantage of the services of a middleman/ middle woman. These people buy the paddy from the farmers field by cash and then

have it milled and sell the finished rice. The farmers appreciate receiving cash on the spot and usually deal with a certain middleman for years. The price of paddies varies by area and by buyer. For example, in Chikereni Weru Weru, some farmers received Tsh 10,000 per 80 Kg bag, while their neighbors received Tsh 14,000 depending on quality and the location of the crop. Within the project area farmers generally receive Tsh 13,000-14,000 per bag.

4-3 Water Management

4-3-1 Irrigation Schemes

(1) Sophisticated irrigation techniques were established.

The water sources are channeled into the irrigation schemes by two intakes, the Mabogini intake on the Njoro river and the Rau intake fed by both the Rau and Njoro rivers. Drainage water from the Mabogini Scheme flows into the Njoro and is recaptured at the Rau intake. Small springs in the Mabogini area also supplement the water supply for a few plots.

The two project intakes have the same basic design, varying only in the dimensions. They are designed as concrete floating weirs, with intake gates protected by trash racks. A flushing gate allows the removal of sediment from the intake. Flow from the intake to the main canal passes through a partial flume, where it is measured. The gates are then adjusted to give the appropriate flow rate. The entire system operates on gravity flow. Primary, secondary and tertiary canals have trapezoidal cross sections and are masonry lined. The project has a total of 10 km of main canals, 25 km of secondary canals and 66 km of tertiary canals. The watercourses which serve the individual plots are earth canals (unlined), except in the Chekereni project, where the farmers have elected to line the watercourses at their own expense.

Land leveling was performed over the irrigation area to improve the uniformity and efficiency of water application. The farmers outside the project practice only a rudimentary system of hand leveling resulting in less uniformity and efficiency of water use.

(2) Irrigation techniques were expanded to surrounding areas

The success of the project has influenced farmers (including some from within the project) to adopt paddy farming with irrigation techniques in areas outside the project,

such as Mandaka and Pasua districts.

Expansion of irrigated paddy cultivation areas has resulted in a considerable increase in paddy production in the whole Kilimanjaro region. Modernized irrigation techniques and water management under Water Users' Association have extended to outside project areas. These facts prove the far-reaching effects of the project.

(3) Intake of water to the project area decreased.

The positive impact on the project area, however, has had a negative aspect, too, because unauthorized use of water upstream of the "outside" project has resulted in a water shortage within the project. In the project design, the irrigation area was based on the low and variable flows in the rivers, and took into account the low probability of effective rainfall under the prolonged drought conditions of the savanna climate.

The expansion of paddy production upstream of the project, using the water intended for the project, is the main cause of the severe water shortages. The reduced water supply available to the project has necessitated a reduction in the cropped area. A system of rotating the blocks which receive irrigation has been interdicted to provide equity among the farmers. In this system, some blocks remain fallow, or are planted with upland crops (non-irrigated), for one or more consecutive cropping seasons. Those which were not irrigated for one or more seasons exhibit higher percolation rates when they are later irrigated. This increases the water requirements and further exacerbates the water shortage.

In addition to this problem, some of the farmers in Upper Mabogini do not follow cultivation schedules decided upon by the CHAWMPU on the advice of the KADP experts. By doing this, they use more than their fair share of water, depriving some of the downstream farmers. In most cases, water shortages are caused by low flow during dry season at initial rainfall. Some farmers in project sites cannot receive enough water from the gate as planned and complain about the irrigation schedule planned by KADP experts when water shortages occur. There have continually been conflicts not only between farmers inside the project and outside, but also between farmers upstream and downstream in the project area.

4-4 Social Impact

The project has drastically changed people's life. Through interviews with about 40 farmers and others in and outside the project, social impact has been found in the following three aspects.

4-4-1 Social Change in the Labor Force and Entrepreneurship

Introduction of paddy cultivation has generated various opportunities for employment. It causes social change in the labor force in and outside the project area, quantitatively and qualitatively.

(1) Wage labor of women generated.

The switch to paddy cultivation from maize has generated wage labor because paddy cultivation requires intensive labor force inputs in the field. Triple cropping cultivation in a year has also made it possible to provide steady jobs for wage laborers since transplanting and harvesting season, which require many laborers, occur one after the other.

Traditional mutual assistance among people has not been found in the project area except in Chekereni village, the former Ujamaa village. People in the project area have migrated into the villages since the 1960s and are ethnically mixed, which is considered a reason for the lack of mutual assistance. In Chekereni village, they have a kind of communal help, but also rely on wage labor nowadays.

Expansion of paddy cultivation has changed farming activities from "unpaid work" which produces food for household consumption to "paid work" which produces food as a cash crop. This could be identified as a substantial change in the labor force.

This opportunity for employment has been expanding not only in the project area but also outside the project area. People come from far mountainous areas in search of job opportunities in the paddies during busy season.

Many of the wage labor opportunities have been for women. Some works which require concentration and skill such as transplanting and weeding are more suitable to women. Gender roles are much clearer in the project area than outside. Women are mostly hired for transplanting and weeding while men are hired for spraying, spreading fertilizer and pesticide (Table 4-4).

Table 4-4 Kind of Tasks in the Field (per 1 plot in the project area)

(1 plot = 0.3 ha)

	No. of people	Period	Labor (*1)	Men/Women	Group/Individual	Cost (Tsh/plot)
Grass cutting	1~4	1 day	△	M	I	2500-7000
Land cleaning	4	1 day	△	M	I	2000-5000
Nursery bed making	1~2	1 day	○	W/M	G	3000
Transplanting	4~6	1-2 day	○	W/M	G	10000-20000
Weeding	4~6	1-2 day	○	W/M	G	8000-10000
Fertilizing	1×3 times	3 days	△	M	I	4500-
Pesticide spreading	1	1 day	△	M	I	?
Bird scaring	1	1 month	○	M	I	10000
Harvesting	4~10	1 day	○	M/W	G	1000/bag

(*1) ○ —Wage labor mainly

△ —Non-wage labor

(*2) Plowing and puddling expenses are included to CHAWAMPU fees.

Some of wage laborers make a group and work together in the project area. Most of them are women who have gathered in a group of four to seven neighbors. Since they have been skilled laborers for transplanting and harvesting through group work, many land owners like to make contracts with such groups. There are noticeable merits of working in a group, such as efficiency and a guarantee of payment to members.

The task of bird scaring has enabled young people to stay in the area and find work. It has even drawn laborers from surrounding districts.

(2) Female middle persons are greatly benefited.

The expansion of rice cultivation has generated new employment opportunities for middlepersons. They manage the task flow of purchasing the paddy rice from the field, carrying it to a milling centre, drying, milling and selling the milled rice to buyers coming from surrounding towns such as Arusha. Around the milling center in the project area, some 10 to 12 women were always serving as middlepersons.

About eighty percent of middlepersons are women. It is interesting to note that when they started this trade, they had considered it as a small business. However, this business has been helping them generate much greater profits

(3) New entrepreneurs are emerging.

In recent years, rice farmers have increasingly invested in shops which deal with daily necessities and food. This indicates an interesting phenomenon of social change in which farmers are becoming entrepreneurs.

An open market trading vegetables and daily goods was opened in the project area, and the flow of goods and people has increased between Moshi town and the project area. With an increased flow of people, transportation has been more frequently available from town to the project area.

4-4-2 Improvement in the quality of life

Income from rice production have many positive results, particularly in meeting basic needs such as food, clothes, housing as well as school fees for children. The results of farm economic surveys, conducted for the project in 1987 and 1991, indicate that the project contributed significantly to the improvement of living conditions. Most farmers feel that their living standards have risen since the implementation of the project (Table 4-3).

Increase in school enrollment is a sign of improvement of living condition. There are four primary schools and one secondary school in the four villages. A few nursery schools have also been built since the project started. Farmers who can afford to hire laborers have come to consider their children not as part of the labor force any longer and they have been eager to send their children to the school.

Water shortages, however, have created a situation in which people face fluctuations in the quality of their lives, having to adjust their expenditures as a result. For example, school enrollments have fluctuated, particularly at the secondary level, and construction of houses has been also interrupted.

4-4-3 Empowerment of women

(1) Income-earning women are empowered.

Increased labor opportunities for women have enhanced their economic status in the family. They have been able to decide how to spend income earned from their labor. Those who can get enough capital to rent plots are eager to cultivate their own paddies. This would enable women to provide food for their children and other family members by themselves.

(2) Women's social status is raised.

The economic empowerment of women has improved their social status. Women who have decision making authority over their own income do not have to rely on their husbands. A woman said that with economic independence from her husband she was confident enough to care for her children by herself. She no longer felt bound by marriage, she added. This has caused no problems in the relationship between men and women in the family. In fact, most men have welcomed women's contribution to the family. In the interview, some men observed that women had become more healthy and attractive since they started earning their own income.

This change in women's status seems to be only small, but in the future may have some larger impact on the relationship between men and women.

Table 4-5 Informant list

	No.	M/F	Resident area	Remark
Farmer	1	F	Oria	
	2	M	Oria	
	3	M	Oria	
	4	F	Rau	
	5	M	Rau	
	6	M	Mabogini	
	7	F	Mabogini	
	8	F	Chekereni	
	9	M	Chekereni	Husband of Group 4 member
	10	F	Mandaka	Living in Moshi town
	11	F	Mandaka	
	12	F	Chekereni-weruweru	Extension officer
	13	F	Chekereni-weruweru	
	14	F	Chekereni-weruweru	Mid-wife
	15	F	Chekereni-weruweru	Wife of Village chairman
Labor group	1	M	Rau	
	1	F	Rau	
	1	F	Rau	
	1	F	Rau	
	1	F	Rau	
	2	M	Rau	Leader of group (M2, F3)
	3	F	Oria	F4 group
	3	F	Oria	
	3	F	Oria	
	4	F	Chekereni	F6 group
	4	F	Chekereni	
	4	F	Chekereni	Wife of Farmer No.9
Women's group	1	F7	Mabogini	17 members
	2	F3		10 members
Nursery teacher		F	Oria	
Head master of Sec. school		M	Oria	
Shopkeeper	1	M	Chekereni	
	2	F	Chekereni	
Middle person	1	F	Chekereni	
	2	F	Chekereni	
	3	M	Chekereni	

4-5 Health Aspects

4-5-1 Malaria and intestinal schistosomiasis due to *Schistosoma mansoni* were found to be endemic.

The rice has been infested by both *Anopheles mosquitoes* (vectors of malaria) and *Biomphalaria* snails (intermediate hosts of the intestinal schistosomiasis). This does not mean, however, that KADC/KADP imported new diseases to the Lower Moshi area. The prevalence rates of intestinal schistosomiasis at Chekereni village increased from a very low rate at 6.4% in 1986 to a moderate rate at 15.3% in 1990, suggesting that the new settlers were exposed to the endemic disease. At Mabogini village, the prevalence rate was higher than at Chekereni (39.2%) in 1986 and rose to 54.8% in 1990, in coincidence with the increase in irrigated areas for rice (Nguma et al., 1991). The traditional villages recorded very high rates between 62.4% and 77.1% in 1990. Unfortunately, the data prior to 1990 are not available. Although it is not mentioned in the original paper by Nguma et al., these high rates may indicate that the infection took place before the start of rice irrigation in 1985. Among those highly infested villages, Rau Kati and Oria are situated along the Rau River, a tributary of which (Mabogini) was found by Shimada (1997) to harbor the *Schistosoma*-infected host snail. The renaububg villages, namely Mtakuja and Mvuleni, are situated in the dry savanna neighboring the sugar cane plantation of TPC, which is a well known endemic area of schistosomiasis.

Katsuki shows in his first report that the new settlers to Chekereni felt deterioration of their health status mainly due to exposure to malaria, then felt improvement thereafter due mainly to better sanitation and nutrition.

Of the two types of schistosomiasis known in Tanzania, the urinary schistosomiasis due to *S. haematobium* was reported to cause female genital complication in Kileo, Mwanga District, Kilimanjaro Region (Bergsjo). This type has been reported only sporadically (average 0.9%) from the Lower Moshi. Yasuraoka reported to JICA that *Bulinus nasutus*, the intermediate host of urinary schistosomiasis, was extremely predominant at Kileo but was absent in his snail samples from the Lower Moshi. Absence of the urinary type in the project area is an advantage which KADP/KATC should keep enjoying. Rigorous epidemiological surveillance and monitoring are essential.

4-5-2 Health conditions were improved through lifestyle improvements

The positive impacts on health were rather indirect through lifestyle improvements, especially in relation to nutrition and housing. Rice has replaced banana as the second most common staple food, while maize remained the first choice. Although this does not necessarily signify an improvement in nutrition, it suggests that other food stuff has been accepted as well. Ijumba et al. shows the rice planting farmers buy more mosquito bednets, coils and anti-malarial drugs than upland farmers in the savanna. Construction of mosquito tight houses using concrete blocks and iron mesh has become popular among better-off farmers in the KADC/KADP area. Others have constructed self contained houses with flush toilets.

Compared to the traditional ways, the new rice cultivating system of KADC/KADP was less prone to malaria and bilharzia. The newly introduced variety of rice (IR54) quickly develops a thicker canopy than traditional varieties, giving less chance for Anopheles mosquitoes to breed in mass. The mechanized preparation of paddies may destroy the ineffective form of Schistosoma larvae (carcaria). Therefore, the farmers have been advised not to add water until transplantation. In addition, KADP has tried to minimize the abundance of both mosquitoes and snails by (1) lining and de-weeding the canals and (2) practicing intermittent irrigation.

4-5-3 Prevention is underway

Because foolproof disease prevention was not possible, the farmers had to rely on the curative measures as well. Diagnosis and treatment are given at hospitals and dispensaries which have no direct relation with the Project. The farmers were well aware of schistosomiasis by the local name “kichocho” and were able to tell about the two different types. However, their awareness of kichocho has sacrificed the awareness of the other diarrhoeal diseases such as amoebiasis and dysentery which show similar symptoms including bloody stools. While schistosomiasis is a chronic and comparatively mild disease, amoebiasis and dysentery are acute and potentially fatal especially to small children. Manifestation of the *Schistosoma eggs* in stools does not necessarily mean that particular abdominal pains and bloody stools were due to schistosomiasis. Since diagnosis of the other diseases is more complicated, regular treatment of schistosomiasis is recommended for simplification of the whole scheme of diagnosis and treatment of diarrhoeal diseases.

The same applies to malaria which is often mixed with other fevrile diseases. The rapid malaria diagnosis methods using Actinide Orange (AO methods) was promoted by MOH through the In-Country Training Course in Tanga. KATC is planning to introduce it to the dispensaries of the Lower Moshi area.

Importance of health education was mentioned by many local people during interviews but very few of them were able to specify the practical messages to be disseminated by such education. The following messages were the most popular but the least practical ones: fill the puddles (against malaria); don't swim in the canal (against schistosomiasis); boil the drinking water (against schistosomiasis). These should be replaced by more practical messages such as: use the insecticide impregnated bed nets (against malaria); avoid contact with the water in the drains (against schistosomiasis); filter the drinking water, use the toilets (against schistosomiasis); etc.

KADP and KATC have recently organized Joint Steering Committee for the Campaign against Schistosomiasis in Lower Moshi, and have carried out a baseline survey in collaboration with CHAWAMPU and TPRI.

KATC has included rice-related diseases as a part of their training courses for farmers from other areas. Two short term experts (Drs. Yasuraoka and Shimada) have visited KATC to investigate the current status of schistosomiasis in the KADP area. They have also provided KATC with recommendations. In addition to this effort initiated by JICA, several institutes located near the project were found active in research and the extension of public health:

(1) TPRI, with its expertise in vector control and use of pesticides, has been collaborating with KADP/KATC for baseline data of malaria and schistosomiasis.
(2) KCMC, due to its missionary background (Lutheran church), receives strong academic and technical support from European countries. It has started a program (MUTAN) on HIV/AIDS, of which the studies on urinary schistosomiasis in Kileo is an integral part. Its experience in health education is an asset exploitable by the Lower Moshi community.
(3) TPC, a Danish originated company, has offered field research opportunities to European parasitologists and epidemiologists. The TPC Hospital should be recognized as a schistosomiasis-specific referral hospital for the Lower Moshi community.

(4) DBL, Danish Bilharzia Laboratory, based in Copenhagen has collaborated with Vector Control Training Center, MOH in Tanga, as well as TPC.

5 Sustainability

The sustainability of KADP is a question of how the positive results of the project can be maintained after project completion. In other words, a question arises as to whether or not the Project purpose and its goals at different levels would be continually achieved based on such factors as self-reliance in management, economy, finance, technology, and other relevant aspects. It also asks whether the project's development impact still meets the needs of society.

Major factors which affect the sustainability of the project are identified as "Important Assumptions" in the Partial Project Design Matrix in Table 5-1, which are listed below by category:

(1) Government policy

・Government policy in support of rice production is maintained.

(2) Economic factors

・Prices of agricultural products do not fall drastically.

(3) Natural factors

・The climate does not change badly.

・Abnormal outbreaks of pests, disease and insects do not take place.

(4) Water resource factors

・Necessary quantity of water for the project area is secured.

・Farmers outside the project area practice paddy cultivation.

・New water resources are secured in Kilimanjaro.

(5) Institutional factor

・Agricultural machinery is lent to the farmers in the project area without difficulties.

Though not mentioned in the Important Assumptions, the management capacity of KADP itself needs to be evaluated for sustainability, from the time it was established as an institution of the Kilimanjaro regional government.

All issues related to the Project's sustainability are noted in the vertical logic of the Project Design Matrix below in relation to means and ends and subject to the project's Important Assumptions.

Table 5-1 Project Objectives and Important Assumptions

Narrative Summary		Important Assumptions
Higher Super Goal	Employment and household income in K. region increased. Agricultural products in Kilimanjaro region increased.	a. Government policy in support of rice production is maintained.
Super Goal	Employment and household income in the project area increased.	a. New water resources are secured in Kilimanjaro. b. Farmers outside the project area practice paddy cultivation.
Overall Goal	Agricultural products in the project area increased.	a. Prices of agricultural products do not fall drastically.
Project Purpose	Irrigated agriculture using modern farming techniques prevailed in the project area.	a. The climate does not change badly. b. Abnormal outbreaks of pests, disease and insects do not take place. c. Necessary quantity of water for the project area is secured.
Outputs	1-11 as in PDM.	a. Agricultural machinery is lent to the farmers in the project area without difficulties.
Activities	1-11 as in PDM.	a. The trained counterpart personnel remain in their jobs. b. Construction of the mill completed by March 1981.

5-1 Government Policy and Project Management Capacity

5-1-1 Government policy

If Government policy to support rice production in Kilimanjaro is maintained, the objectives of KADP will be sustained subject to the satisfaction of all other Important Assumptions. Here, important indicators of Government's support to the Project are reflected in the resources allocated to the local budget and the staffing provisions made to the project by the regional and national Governments. The extent of this kind of support indicates the government's level of commitment.

Table 5-2 shows that the actual expenditure consistently fell short of the committed budget except in 1986/87 and 1988/89. More details show that actual expenditure as a share of the budget was no more than 6.0 to 8.0 percent during the early period of KADC, but after 1984 steadily increased from 46.0 percent to as much as 120.0 percent through

1991 when KADP was in full operation. This indicates that the Government's full support for KADP commenced toward the end of KADC in FY1984/85 and that substantial budgetary disbursements continued from the beginning of KADP until FY1991/92. In 1994/95, when JICA's cooperation ended, the majority of project activities were transferred to the rice grower's cooperative, CHAWAMPU and hence the role of the Government in the development of Lower Moshi, including the management of CHAWAMPU, was greatly reduced. The Tanzanian Government has faced a chronicle budget shortage; therefore, shortfalls in its expenditure were very common. In this respect, the Government's financial support of over 70% of the Project Budget was indeed significant.

Table 5-2 Budget and Expenditure of KADC/KADP by the Government of Tanzania

Year	(A) Amount	(B) Amount Released		B / A (%)
	Budgeted (TSH)	Recurrent Exp.	Develop. Exp.	
1981/82	2,492,806	---	---	
1982/83	2,769,785	164,125	---	5.94
1983/84	3,077,541	241,435	---	7.85
1984/85	3,419,490	474,800	1,830,000	67.4
1985/86	3,761,439	320,150	2,256,000	68.5
1986/87	3,495,000	4,180,390	---	119.61
1987/88	12,991,650	5,141,200	---	39.57
1988/89	10,086,086	12,449,215	---	123.43
1989/90	33,733,308	14,265,000	3,625,000	53.03
1990/91	39,613,308	15,512,826	2,800,000	46.23
1991/92	55,331,908	38,624,380	---	69.80
1992/93	85,600,790	12,110,889	---	14.15
1993/94	92,600,790	10,475,960	---	11.31
Total	348,973,901	113,960,370	10,511,000	35.67

Source: KADP

5-1-2 Project management capacity

Chart 5-1 shows the organizational chart of KADP. KADP succeeded KADC as a part of the Organization, covering operation and management of Lower Moshi as well as project construction and development outside the Lower Moshi area. KADP had three major functions of conducting research, human resources development and technological dissemination. While KADC had 50 to 60 staff members, under KADP the number of

staff increased to 140 and later to 200. University graduates were only 5 out of 200. Nevertheless, technical advice and guidance offered by Japanese experts could have brought the level of expertise to a higher degree, but not a fully desirable level as yet. As a result, complete self-reliance on the level of technical capacity was not achieved, even though 14 counterpart personnel were trained in Japan. At present, 11 persons still remain at KADP, continuing their services and the skilled staff of 60 has been able to operate and manage the project without major difficulties. From 1986 to 1993, a total 781 personnel (292 extension officers and 247 operators and supervisors of tractors, and 242 farmers) and 19 counterparts were trained.

It is a fact, however, that there is an insufficient capacity to provide management guidance to rice growers' cooperatives in such areas as finance, accounting, and tractor hire services. The tractor hire services are expected to expand in the future, but still not to an inadequate level. This would be an important capacity to strengthen until the tractor hire services by CHAWAMPU become financially sustainable as two Japanese experts remain to assist them. The weakness of KADP's management capacity is indeed equal and linked to that of CHAWAMPU rice growers.

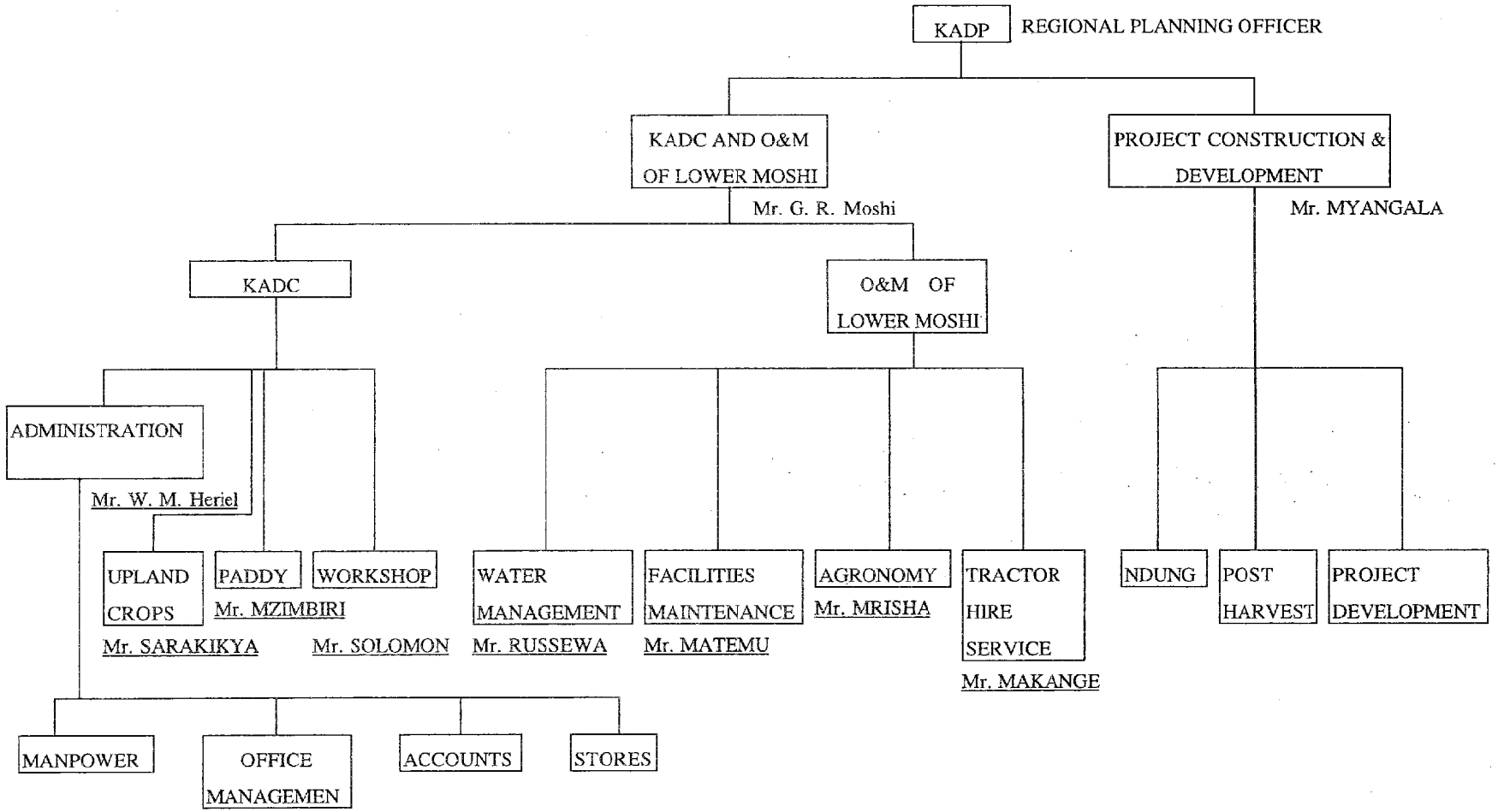


Chart 5-1 ORGANIZATIONAL CHART OF AKILIMANJARO AGRICULTURAL DEVELOPMENT PROJECT

5-2 Economic Aspects

The logic between Super Goal and Overall Goal in PDM is that if rice production in the project area increases, then the employment and household income in that area will increase, unless rice prices fall drastically.

Prices of agricultural products were identified in the PDM as factors which would affect the region's economic prospects. In spite of technical improvement in the cultivation of upland-crops such as beans, maize and vegetables, these products did not bring about significant changes in the agricultural production system, due to water shortage. Benefits accrued from upland crops in the project were, therefore, limited, and the production system shifted toward increased rice production whenever water is available, because of the rising rice prices which made the crop more profitable than upland crops (See Table 4-1).

In 1985 and 1993, consumer prices rose by 7.6 times, while rice prices (Tsh/kg) in Kilimanjaro increased by 6.7 times from Tsh 15.00 to Tsh 100.00. Rice prices increased overtime, corresponding to inflation, at a slightly lower rate. During the same period, it is estimated that gross income generated by rice production grew by 53.4 times from Tsh 11,837,850 to Tsh 632,339,520 due to the increment of rice harvests. (See Table 4-1) Discounted by the price hike, the real increase of gross income rose about 8 times. When it is extended to the year 1996, gross income from rice increased by 79.4 times which is, in real terms, 6.8 times as large as the year 1985. Financially, farmers were greatly benefitted out of this.

The high income of the rice farmers owes in large part to the rising price of rice. This has also been a major incentive for farmers to increase irrigated rice cultivation. The current high price of rice is due to the food shortage across Tanzania and greater shortages in neighboring Kenya. As thia situation is not expected to improve over the short term, rice prices will probably remain high.

On the other hand, increased rice production in Tanzania is continuing. However, in five to ten years, rice supply is unlikely to grow fast enough to fill the gap between demand and supply of food in the country, since the population is growing faster than food production. Consequently, rice prices will maintain the incremental trend, and the high income earned by full-time rice farmers today will be sustained, unless something like foreign food aid will bring about a drastic change in the market situation.

5-3 Agriculture

5-3-1 Rice production outside the project area

It was expected that if employment and household income through rice production in the project area increased, then rice yields in the Kilimanjaro region generally would increase, as farmers outside the project area take up paddy cultivation. As expected, the income of rice farmers in the project area increased, and the farmers outside the project area also began to practice paddy cultivation, resulting in the remarkable increase of the total rice production in the region. This was the up side.

However, another important assumption that “the necessary quantity of water for the project area is secured, ” was not satisfied. As a result, water resources in the project area were reduced sharply and the amount of rice yields declined year by year. This was the down side.

Due to the success of the project, paddy production has spread all over the region at a high speed, wherever water resources are available. The project itself ended up suffering a set back due to a water shortage and the fact that new water resources were not secured until now, as was originally assumed.

Nevertheless, complementary water resources for the project area were found in April 1997. A feasibility study is already under way by JICA, increasing the possibility that in a few years time new water will be available to the project area, and that the original plan for rice and upland crops production will be realized. Until then, the present water shortage situation threatens the sustainability of the project.

5-3-2 Pests, diseases and insects

IR54, the most popular rice variety, is cultivated more extensively than 10 years ago. So far, no outbreaks of pests, diseases and insects hazardous to the rice production in the region have been reported. But experts are concerned about the consequences of such outbreaks if they should occur. Further research may be required as to the introduction of alternative rice varieties.

5-3-3 Tractor hire services

CHAWAMPU operates tractor hire services exclusively for the project area. Rental fees are subsidized by the project and they vary year by year depending on the prices of fuel, spare parts and inflation in general. At present, the tractor hire services are un-

der-utilized especially in the Lower Moshi. However, if rice cultivation was expanded to 6,000 ha, they would not have the capacity to offer uniform services to all farms.

Outside the project area, farmers are cultivating manually, but there is not enough farm labor available for expansion. There appears to be two alternatives: first, the utilization of animal drought power (not presently used) and second, expansion of tractor hire services which could be expensive, and impossible to effect without foreign assistance. Moreover, the management structure of CHAWAMPU requires a careful examination and analysis of the sustainability of tractor hire services. Animal drought power is currently utilized in other regions of Tanzania. The introduction of this kind of intermediate technology may have to be considered for the sustainable development of irrigated rice production.

5-4 Water Management

The physical sustainability of the project will depend on the following factors: ① adequacy of the water supply, ② maintenance of soil fertility and environment, ③ maintenance of the irrigation facilities, ④ the farmers' organization, ⑤ technical support.

Farmers' participation is an important factor in the successful implementation and sustained performance improvement of the project because the government cannot handle all the tasks of irrigation development on its own. Inequitable water distribution, wasting of water at the farm level and poor maintenance of the system may adversely affect the system. Irrigation is basically a cooperative undertaking as it involves the sharing of a limited resource among numerous users.

5-4-1 Maintenance of Soil Fertility and Environment

The Lower Moshi area is located on an alluvial fan consisting of accumulated volcanic rocks, pumice, scrolls and volcanic ash from Mt. Kilimanjaro. Water passes through the surface soil easily and is often as deep percolation. In many cases, this water re-emerges as springs in the vicinity of the upper-elevation periphery of the project. The rivers and springs in the area are fed by snow melt from the slopes of Mt. Kilimanjaro, supplemented by precipitation during the short rainy season. Rainfall outside of the rainy season is infrequent and unreliable. Average percolation value in Upper Mabogini is 20.8 mm/day, in Lower Mabogini 36.68, Rau 32.04, Chekereni 34.37, and Oria 35.25. Recently, the percolation value has dropped. However, the water depth requirement in

the leaking paddy field is more than 7-8 mm/day, which was the estimate in the feasibility study.

Signs of soil salination have appeared both outside the project and within the project area, since the implementation of paddy cultivation. This situation should not present a serious hazard, since the soil can easily be drained and during the rainy season there is enough surplus water to provide leaching. Some additional drainage installation (preferably sub-surface) may be needed.

The project is located in the middle reaches of the river basin. The project area forms a part of the river basin and should have symbiotic relationships with surrounding areas. Conservation of the watershed, and preservation of the natural environment is essential. Apart from the benefits to the watershed, conservation of the watershed will reduce the siltation of the irrigation facilities, and will maintain the current hydrologic balance, ensuring stable water supplies. On the other hand, severe damage to the watershed could result in increased salination and possibly flash floods, followed by periods of below-average river flows.

5-4-2 Water Quality

The quality of the water is highly suited for irrigation, being low in total dissolved salts, with an electrical conductivity of 120μ/S/cm. The Sodium Absorption Ratio is low (1.26). Irrigation suitability is classified as C1-C2, having a low sodium hazard. The monthly distribution of flow over the 8-year period, 1987-1994, is fairly uniform, though the total flow is not large. The project has water rights to get 804 l/s from this source, but the available flow does not often permit this rate of abstraction. The Rau River originates in the mountains north of the project area. It is also fed by several springs along its course. The monthly distribution of flow over the 8 years, 1987-1994, is much more variable than that of the Njoro river. As for the Njoro, the quality of water is well suited for irrigation, with SAR of 0.46 to 1.14, and an Electrical Conductivity of 106 to 195μ/S/cm.

5-4-3 Water Balance

The Lower Moshi Irrigation Schemes receive their water from 2 main sources, the Njoro and Rau rivers. The Njoro river, which is a tributary of the Rau, is supplied from a spring located in the outskirts of the town of Moshi, and further augmented by run-off

along its course. The river passes through an area of Upper Mabogini which is upstream of the intake for the project, and an unquantified amount of water is extracted by non-project farmers, thereby reducing the amount available for the project.

The Rau river which serves the Rau, Chekereni and Oria Schemes, is also a source of water for a number of farmers upstream of the project. These farmers have been expanding their paddy production as a result of the success of their neighbors within the project. In this decade, the estimated paddy cultivation of 1,600 ha/year in Mandaka and 1,000 ha/year in Pasua, located upstream of the Rau river, have increased. Total water inflow in the Njoro system is estimated at 1,757 l/s and in the Rau system at 947 l/s. However, the water requirement of the Pasua area is 700 l/s, Mandaka1,040 l/s, Kwaaningo 200 l/s, Usagara 60 l/s and KADP 1,240 l/s. Total water consumption of the total cultivated area is estimated at 3,240 l/s. This has led to a shortages of water within the project, which cannot often utilize its full water rights of 1,135 l/s from this source.

5-4-4 Water Supply

The water supply at present is inadequate for the area under cultivation (both inside the project area and upstream of the project). This is not a sustainable condition. Fortunately, plans are under way to extend the project to a total of 6,000 ha, which will include the present area, the current farms outside of the project which are using water allocated to the project, and new land. A new water source has been identified to serve this expanded area (an intake from the Kikuletwa River). This is estimated to be enough flow to satisfy the current water deficits as well as the requirements for the expansion areas. It is expected that, in the near future, the water shortages will no longer be a constraint.

5-4-5 Maintenance of the Irrigation Facilities

The project is strongly supported by the efforts of the Kilimanjaro Agricultural Training Center, which trains irrigation technicians and farmers in many aspects of irrigated farming. Training courses under KADP, such as Agricultural Machinery, Irrigation and Drainage, Paddy Cultivation and Upland Crop Cultivation are held in KADC.

The irrigation facilities are operating well at present, and CHAWAMPU and the farmers are doing their part to repair and clean the canals. As the system ages, more extensive maintenance may be needed. CHAWAMPU will have to grow into this role to

ensure the long-term sustainability of the project.

5-4-6 Conflicts

In projects, it is not unusual to have conflicts between participants. Most of the conflicts in this project arise from scarcity of water. There have often been conflicts between farmers inside the established irrigation scheme and those outside of the project, and between farmers at the downstream end of the scheme, and those at the upstream end of the scheme who do not follow the authorized irrigation schedule. Conflicts are usually settled with the assistance of CHAWAMPU, whose officers are usually respected members of the village community. This has helped alleviate the problem. New water sources have been identified, and in time there will be an adequate supply of water for the entire project area, and most of the farmers currently farming outside of the project area will be incorporated into the project.

5-4-7 Institution Building: Farmers Participation and CHAWAMPU

On the slope of Mt. Kilimanjaro at an elevation of 900-2,000m, a great number of small-scale irrigation systems have prospered for centuries. Such irrigation systems are called “traditional furrows.” The traditional furrows have no legal water rights. There were 40 irrigation intakes in the Lower Moshi area, of which 28 were distributed along the Rau river and 12 along the Njoro river. Traditional water utilization for irrigation is one of the factors of water shortage and conflict. A key to the settlement of the water shortage will be adjustment of the whole watershed between the project site and outside. All the farmers will be expected to take responsibility for coordinating water management.

The existing farmers organization, CHAWAMPU, is serving the project well, but it is still in its infancy, and one cannot take for granted that it will continue to function adequately and evolve to meet the future needs of the project. A strong farmer organization is essential to the long-term sustainability of the project. The interviewed farmers were very much aware of this. Some of the areas in which the sustainability of the present organization, CHAWAMPU, could be improved include:

(1) Increased membership: A strong effort to recruit more members is needed. At present, only 45% of the project farmers belong to CHAWAMPU. At least a strong majority of the farmers should belong to the organization to make it

really representative.

(2) Long-range vision and planning: At present, CHAWAMPU is completely preoccupied with short-term issues of water allocation and conflict resolution. Long-term planning is needed to address such issues as replacement of tractors, repairs to facilities, and securing credit facilities for farmers. CHAWAMPU may be also begin at an early stage to consider the need to engage their own experts after the eventual withdrawal of technical assistance.

(3) With the planned increase of farm land, strong consideration should be given to bringing the entire project area (including the new areas) under one strong farmers' organization.

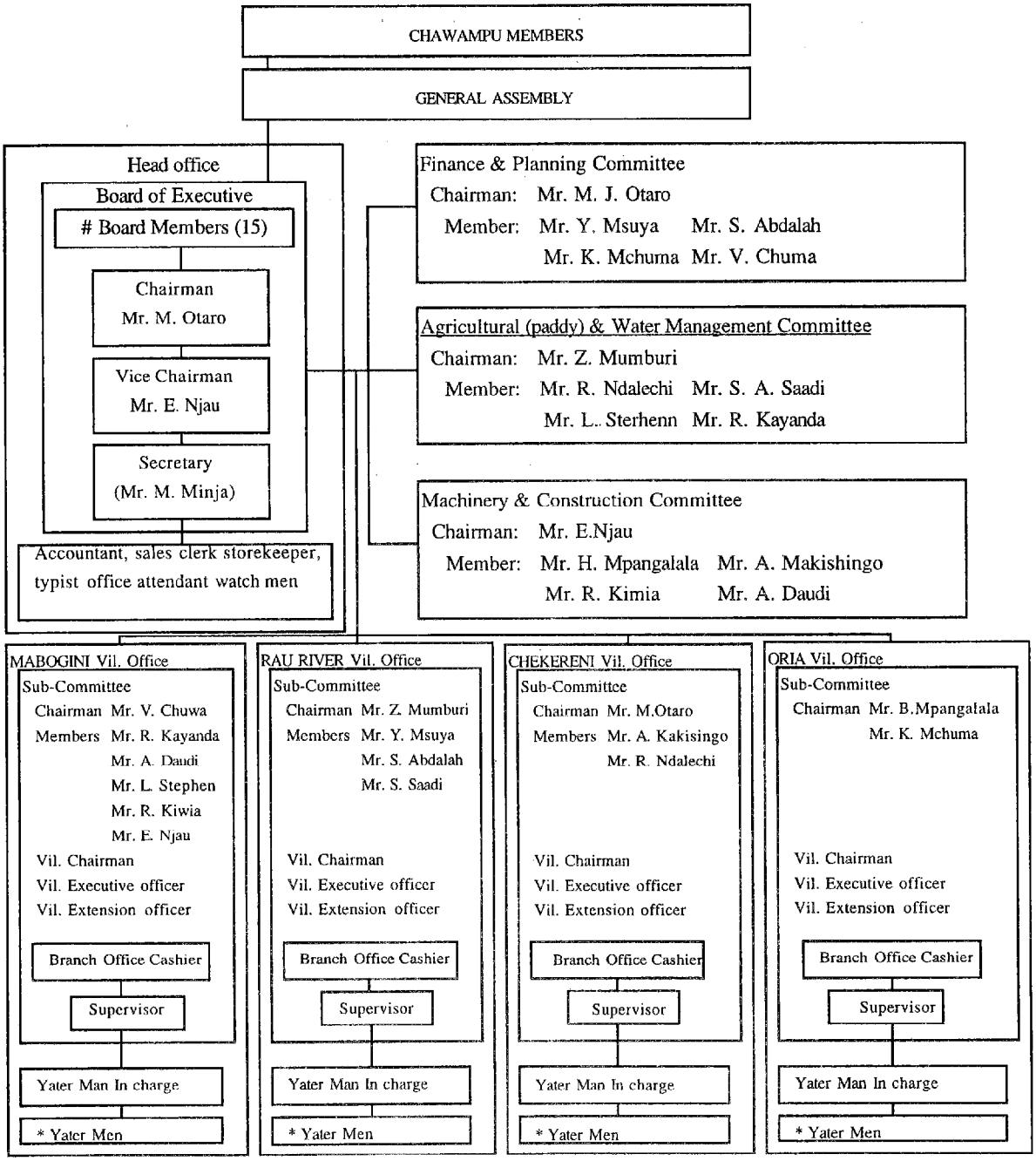
(CHAWAMPU RURAL CO-OPERATIVE SOCIETY LTD)

Reg. No. KLR 415

MKOA WA KILIMANJARO
Simu
Unapojibu Nukuu:
Kumb. Na _____

OFISI YA CHAWAMPU, S.L.P.
1438,
MOSHI.
Tarehe _____

CHWAMPU ORGANIZATIONAL CHART



Remarks: # Elected by farmers. Mabogini, 6 members, Rau, 4 members. Chekerni 3 members, Oria 2 members (Total 15 members)

* Approximately 20 - 40

K. A. D. P counterparts are adviser for all committees.

JAN. 1997 CHAYAMPU

Chart 5-2 CHAMA CHA WAKULIMA WA MPUNGA ORGANIZATIONAL CHART OF CHWAMPU

5-5 Health Aspects

It is essential to consider the risk of malaria and schistosomiasis when introducing sustainable rice irrigation in Sub-Sahara Africa. These two diseases should be accepted as a risk which is almost unavoidable but fairly controllable. The control campaign should include the following integral parts: ① community protection including environmental management, ② personal protection, ③ diagnosis and treatment, ④ monitoring and research and ⑤ health education. In view of the present evidence of the diseases, vigorous integral health management will be needed when more irrigation water is introduced into the Lower Moshi. (See Chart 5-3)

5-5-1 Community protection including environmental management

Community protection differs from personal protection in that the actor/investor is not directly protected. In order to reduce the breeding beds of the host snails in the paddies, lining the drains should be considered as long as the costs can be met. Building bridges and culverts around the drains may have a similar effect with much lower costs. Building and usage of field toilets is strongly recommended. Participation of the community members in planning and monitoring is essential in order that the toilets are owned and efficiently utilized by the community. Strict intermittent irrigation for malaria control will become more important than ever when sufficient water is introduced for continuous cropping. These measures should be initialized be KADP, but gradually taken over by the community especially through the cooperatives.

Some of the control measures often recommended in the previous documents may not be technically applicable to the Lower Moshi. Biologic control of the snail intermediate hosts of schistosomiasis with the competitive snails (*Marisa cornuarietis*) is not recommended, although it was successful in the sugar cane plantation of TPC, because *Marisa* is known to be a serious pest of rice seedlings. Meshing the control boxes of irrigation channels is unrealistic because of easy clogging and possible theft. The intradomiciliary spraying of insecticides against malaria mosquitoes is effective only when virtually every one in community is covered.

5-5-2 Personal protection

Farmers already know they can protect themselves from malaria by screening their houses as well as by the use of insecticide impregnated mosquito nets, mosquito coils

and other protective measures. Community cooperatives can facilitate the farmers to take necessary action by wholesale purchase of insecticides and other materials which should be sold retail to farmers. Use of filters for drinking water should be promoted to prevent diarrhoeal diseases especially among those who can afford to it.

For self-protection against schistosomiasis, behavioral change is important. Avoid contact with snail-infested water especially in bathing. More studies are needed to establish the major contact points.

5-5-3 Diagnosis and treatment

Health facilities should equip proper tools and materials for accurate diagnosis. Microscopic diagnosis is practical and essential for both diseases. The rapid diagnostic method of malaria parasite using Acridine Orange (AO method) should be implemented. Since praziquantel, the best drug against schistosomiasis, will be reportedly removed from the government's kit of essential drugs, the community cooperatives are advised to prepare stocks.

Most health facilities badly need technical assistance and advise, which should be sought at research institutions. The community cooperatives should coordinate regular contacts between these two parts.

5-5-4 Research and monitoring

Accumulation of base-line data and monitoring are essential where drastic changes in health status, both positive and negative, are expected. KADP/KADC should establish such collaborative relations with the local research institutes and hand them over to the community cooperatives. Emphasis should be on possible invasion of *Bulinus* snails and urinary schistosomiasis due to *S. haematobium* into Lower Moshi. Collaboration with KCMC is strongly recommended.

5-5-5 Health Education

Health education should be recommended on community protection through the field latrines as well as personal protection such as protective housing, the use of insecticide impregnated nets, bathing in safe water, etc. Coordination with local research institutes, health facilities and school is needed. The use of toilets is more promising for the control of the intestinal schistosomiasis.

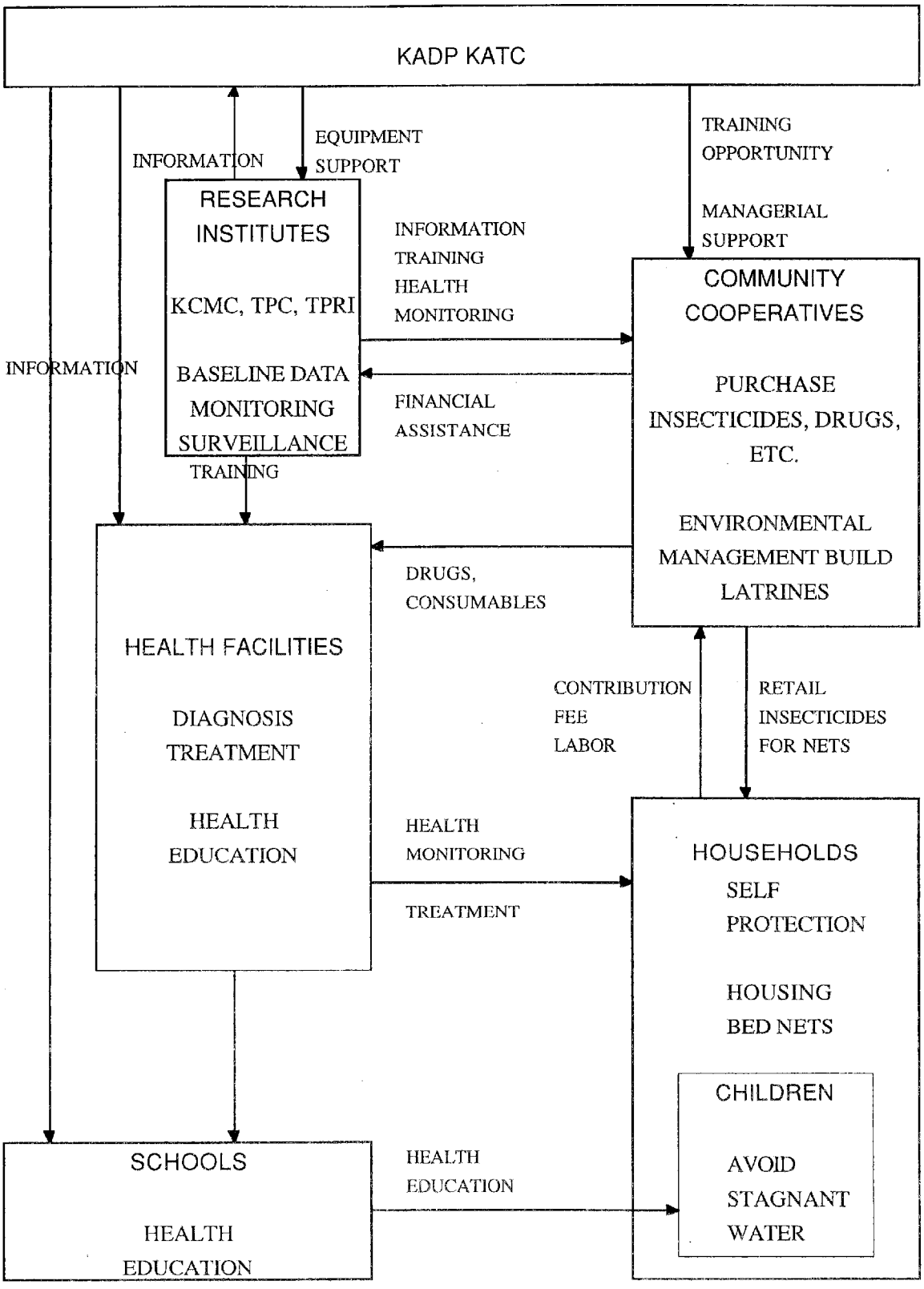


Chart 5-3 INTEGRAL HEALTH MANAGEMENT IN LOWER MOSHI IRRIGATION PROJECT A PROPOSAL

6 Accountability and Elements for Success

KADP is a landmark project in JICA's agricultural development cooperation for Africa, which effected epoch-making impact on the Kilimanjaro region by motivating impoverished farmers to better their living conditions. There is yet a need to clarify project accountability and the elements contributing to its positive impacts.

6-1 Accountability

Table 6-1 shows the inputs from Japan and Tanzania on cash flow basis. The figures between 1994 and 2003 were estimated on the assumption that Japan would assist Tanzania by providing two Japanese experts for five years and that the Tanzanian Government is to reduce running costs to one-third of level in 1993, as the staff was reduced to about one third. Inputs for the construction works were distributed on a monthly basis for the required period to indicate the cash flow. From Table 6-1 it is learned that Japan would contribute the total amount of US$ 48,599,386 and Tanzania would provide US$ 7,080,439 to the project, making a total sum of US$ 55,679,825 between 1980 and 2003.

Table 6-2 shows gross income generated from rice production in the Project area in Lower Moshi. The figures between 1997 and 2003 were estimated on the assumption that the same level of yield in 1996 would continue and that the price level of rice per kg in 1996 will be maintained up to 2003. This assumption is based on the fact that conflicts on water issues in the project area are getting controlled by the efforts of farmer's cooperative, "CHAWAMPU", assisted by the KADP project and that rice yield was dramatically improved it the half level of the peak yield in 1990. Out of Table 6-2 it was estimated that the project would generate the gross income of US$ 34,511,409 between 1985 (the second year of the construction of the irrigation) and 2003.

Table 6-3 indicates the estimated yields of upland crops in the project area between 1984 and 2003. The Table was produced based on the land use for the upland crops in the project area in 1996; Maize 2,230 ha, Beans 85 ha, Vegetable 14 ha, Sunflower 53 ha, Millet 48 ha, Banana 40 ha, others 35 ha. The estimate for other crops was omitted because the data was not available. The annual yield for each crop was calculated based on each average yield (ton/ha) in the Kilimanjaro region. The figures between 1996 and 2003 were estimated on the assumption that the level of 1995 will continue up to 2003.

Table 6-1 Total Inputs of Japanese and Tanzanian Governments

	Inputs of Japan					Inputs of Tanzania			
	Technical Cooperation (1,000 Yen)	Capital Grant Aid (1,000 Yen)	Yen Loan (1,000 Yen)	Total Yen (1,000)	Total US$	Technical Cooperation (Tsh)	Non-Technical Cooperation (Tsh)	Total Tsh	Total US$
1980	79,557	700,000		779,557	3,422,112				
1981	292,742	700,000		992,742	4,478,872				
1982	260,031			260,031	1,039,708	164,625		164,625	17,740
1983	327,150			327,150	1,371,583	241,435		241,435	21,673
1984	253,221		733,333	986,554	4,134,934	2,304,800	28,533,111	30,837,911	2,016,868
1985	222,921	800,000	1,100,000	2,122,921	8,860,271	2,576,150	42,799,668	45,375,818	2,597,356
1986	215,388		1,100,000	1,315,388	7,758,113	4,180,390	42,799,668	46,980,058	1,436,699
1987	247,275		366,667	613,942	4,214,608	5,141,200	14,266,556	19,407,756	302,019
1988	240,516	66,000		306,516	2,372,598	12,449,215		12,449,215	125,382
1989	198,666	596,000		794,666	5,717,022	17,890,000		17,890,000	124,773
1990	204,379			204,379	1,401,488	18,312,826		18,312,826	94,299
1991	105,621			105,621	779,376	38,624,380		38,624,380	197,063
1992	79,420	100,000		179,420	1,405,342	12,110,889		12,110,889	51,778
1993	4,635			4,635	41,306	10,475,960		10,475,960	31,272
1994	35,000			35,000	339,147	3,491,987		3,491,987	6,710
1995	35,000			35,000	368,034	3,491,987		3,491,987	5,734
1996	35,000			35,000	318,645	3,491,987		3,491,987	6,384
1997	35,000			35,000	288,113	3,491,987		3,491,987	6,384
1998	35,000			35,000	288,113	3,491,987		3,491,987	6,384
1999						3,491,987		3,491,987	6,384
2000						3,491,987		3,491,987	6,384
2001						3,491,987		3,491,987	6,384
2002						3,491,987		3,491,987	6,384
2003						3,491,987		3,491,987	6,384
Total	**2,906,522**	**2,962,000**	**3,300,000**	**9,168,522**	**48,599,386**	**159,391,740**	**128,399,003**	**287,790,743**	**7,080,439**

Source: JICA, OECF, KADP

Note: Figures between 1995 and 2000 were estimated on the assumption that;

(1) Japan would provide two Japanese experts for 5 years

(2) Tanzania would reduce the running costs to one-third of the level in 1993

Table 6-2 Gross Income Generated from Rice Production in the Project Area

	Estimated Paddy Yield (t)	Average Paddy Price (Tsh/kg)	Estimated Gross Income (Tsh)	Gross Income (US$)
1985	789.19	15.00	11,837,850	677,610
1986	4,239.81	19.50	83,748,630	2,561,120
1987	6,179.16	27.25	168,478,510	2,621,826
1988	8,385.12	30.00	251,553,600	2,533,524
1989	8,439.50	32.67	275,003,220	1,918,003
1990	10,659.90	44.33	472,053,320	2,430,759
1991	8,015.30	72.50	589,264,075	3,006,449
1992	7,120.68	93.75	667,029,125	2,851,771
1993	6,811.76	100.00	632,339,520	1,887,581
1994	3,792.65	117.50	440,067,100	845,665
1995	2,884.15	156.25	446,021,875	732,396
1996	5,370.91	175.00	939,909,250	1,718,298
1997	5,370.91	175.00	939,909,250	1,532,344
1998	5,370.91	175.00	939,909,250	1,532,344
1999	5,370.91	175.00	939,909,250	1,532,344
2000	5,370.91	175.00	939,909,250	1,532,344
2001	5,370.91	175.00	939,909,250	1,532,344
2002	5,370.91	175.00	939,909,250	1,532,344
2003	5,370.91	175.00	939,909,250	1,532,344
Total	**110,284.50**		**11,556,670,825**	**34,511,409**

Source: KADP

Note: Figures between 1997 and 2003 were estimated on the assumption that the same level of yield in 1996 would be maintained up to 2003.

Table 6-3 Estimated Upland Crops Yield in the KADP Project

	Maize (ha)	2230	Beans (ha)	85	Vegetable (ha)	14	Sunflower (ha)	53	Millet (ha)	48	Banana (ha)	40
	average yield (ton/ha)	annual yield (ton)	average yield (ton/ha)	annual yield (ton)	average yield (ton/ha)	annual yield (ton)	average yield (ton/ha)	annual yield (ton)	average yield (ton/ha)	annual yield (ton)	average yield (ton/ha)	annual yield (ton)
1984	1.192	2658.16	0.425	36.125	10.00	140.00	0.618	32.754	0.496	23.808	6.906	276.24
1985	1.663	3708.49	0.507	43.095	10.00	140.00	0.617	32.701	1.219	58.512	10.468	418.72
1986	0.572	1275.56	0.385	32.725	10.00	140.00	0.663	35.139	0.175	8.400	8.093	323.72
1987	1.837	4096.51	0.450	38.250	10.00	140.00	0.617	32.701	0.851	40.848	10.125	405.00
1988	1.575	3512.25	0.675	57.375	10.00	140.00	0.618	32.754	0.750	36.000	8.000	320.00
1989	1.870	4170.10	0.618	52.530	9.71	135.94	0.882	46.746	0.742	35.616	9.460	378.40
1990	1.446	3224.58	0.924	78.540	9.71	135.94	0.997	52.841	0.598	28.704	9.529	381.16
1991	1.977	4408.71	0.587	49.895	11.00	154.00	0.850	45.050	0.712	34.176	10.430	417.20
1992	0.842	1877.66	0.266	22.610	4.45	62.30	0.100	5.300	0.671	32.208	9.487	379.48
1993	1.520	3389.60	0.432	36.720	6.67	93.38	0.842	44.626	0.743	35.664	4.845	193.80
1994	1.700	3791.00	0.605	51.425	9.76	136.64	1.000	53.000	1.208	57.984	7.534	301.36
1995	1.516	3380.68	0.520	44.200	9.54	133.56	0.745	39.485	0.805	38.640	8.328	333.12
1996	1.516	3380.68	0.520	44.200	9.54	133.56	0.745	39.485	0.805	38.640	8.328	333.12
1997	1.516	3380.68	0.520	44.200	9.54	133.56	0.745	39.485	0.805	38.640	8.328	333.12
1998	1.516	3380.68	0.520	44.200	9.54	133.56	0.745	39.485	0.805	38.640	8.328	333.12
1999	1.516	3380.68	0.520	44.200	9.54	133.56	0.745	39.485	0.805	38.640	8.328	333.12
2000	1.516	3380.68	0.520	44.200	9.54	133.56	0.745	39.485	0.805	38.640	8.328	333.12
2001	1.516	3380.68	0.520	44.200	9.54	5.00	0.745	39.485	0.805	38.640	8.328	333.12
2002	1.516	3380.68	0.520	44.200	9.54	133.56	0.745	39.485	0.805	38.640	8.328	333.12
2003	1.516	3380.68	0.520	44.200	9.54	133.56	0.745	39.485	0.805	38.640	8.328	333.12
Total		**66538.74**		**897.09**		**2491.68**		**768.98**		**739.68**		**6793.16**

Source: KADP

Note: (1) Average yield (ton/ha) was estimated based on the yields/cultivated land in Kilimanjaro region.

(2) Yield in 1995 is average yield per ha between 1984 and 1994.

(3) Figures between 1995 and 2000 were estimated on the assumption that the level of 1995 would continue up to 2003.

(4) Land use for each crop is based on the figures in 1996.

Table 6-4 shows the estimated income generated from upland crops in the project area. Prices of the crops such as Sunflower and Millet and Banana which were not available for some years were simulated from the vegetable prices which showed generally clear of the market situation. In Table 6-4 it is estimated that the total income generated from upland crops amounts to US$ 21,323,692.

As described in the previous chapters, it was recognized that there was a substantial impact upon farmers in the Kilimanjaro region who cultivated in the outside area of the KADP project in Lower Moshi. As a result, similar methods of rice production expanded not only to the neighboring areas in Lower Moshi district but also all over the Kilimanjaro region wherever water was available. This phenomena broke out after the construction of the irrigation scheme of Lower Moshi (2,300 ha) was completed in 1987. Table 6-5 shows the estimated gross income generated outside the project area as an impact of the project. As observed in Table 4 the significant increase in the rice yield in the region commenced in 1988, marking more than double of the yield in 1987. Net increase in yield of rice as an impact was estimated in the following formula:

Net increase in rice yield = Total rice yield in K. region in year N - Total rice yield in K. region in 1987 - Total rice yield in the Project area in year N

(K stands for Kilimanjaro)

The figures between 1995 and 2003 were estimated on the assumption that the same level of rice yield in 1994 will continue after 1995 until 2003, and that the price level in 1996 will continue up to 2003. This assumption is based on the fact that the general social and economic circumstances in the Kilimanjaro region are increasingly more favorable to rice farmers since 1994. The Government's technical and financial support to the "CHAWAMPU" remains strong and so is motivation of rice farmers to continue rice production. In Table 6-5 it is learned that gross income generated outside the project area amounted to US$ 54,305,776.

Table 6-6 shows the economic analysis of the KADP project based on the former Tables 6-1 through 6-5. The Table explains that with the discount rate of 15% cost benefit ratio is estimated as 128.7% and similarly with 12%, it is 136.9%. Economic Internal Rate of Return (EIRR) is estimated as 8.3%. According to OECF study after completion of the irrigation project, EIRR was estimated as 11.2%. The present estimate is slightly lower than that rate, however, this is a conservative estimate, since, the actual price of rice tends to rice and the rice yield outside the project area seems to be increasing further,

Table 6-4 Estimated Upland Crops Income in the KADP Project

	Maize			Beans			Vegetable		
	Yield (ton)	Price (Tsh/kg)	Income (Tsh)	Yield (ton)	Price (Tsh/kg)	Income (Tsh)	Yield (ton)	Price (Tsh/kg)	Income (Tsh)
1984	2658.16	7.60	20,202,016	36.125	31.25	948,281	140.00	26.250	3,675,000
1985	3708.49	7.60	28,184,524	43.095	31.25	1,131,244	140.00	26.250	3,675,000
1986	1275.56	12.20	15,561,832	32.725	28.75	695,406	140.00	21.250	2,975,000
1987	4096.51	12.20	49,977,422	38.250	31.25	1,329,188	140.00	34.750	4,865,000
1988	3512.25	17.00	59,708,250	57.375	43.75	2,438,438	140.00	42.500	5,950,000
1989	4170.10	23.00	95,912,300	52.530	65.00	2,363,850	135.94	45.000	6,117,300
1990	3224.58	36.45	117,535,941	78.540	64.29	4,241,160	135.94	54.000	7,340,760
1991	4408.71	45.05	198,612,386	49.895	77.14	3,233,196	154.00	64.800	9,979,200
1992	1877.66	61.11	114,743,803	22.610	107.14	2,034,900	62.30	90.000	5,607,000
1993	3389.60	55.56	188,326,176	36.720	153.00	4,085,100	93.38	111.250	10,388,525
1994	3791.00	95.22	360,979,020	51.425	343.00	7,349,661	136.64	142.920	19,528,589
1995	3380.68	83.11	280,968,315	44.200	325.00	7,612,124	133.56	172.220	23,001,703
1996	3380.68	103.33	349,325,664	44.200	322.00	8,237,112	133.56	186.360	24,890,242
1997	3380.68	111.89	378,264,285	44.200	322.00	9,576,814	133.56	216.670	28,938,445
1998	3380.68	111.89	378,264,285	44.200	322.00	9,576,814	133.56	216.670	28,938,445
1999	3380.68	111.89	378,264,285	44.200	322.00	9,576,814	133.56	216.670	28,938,445
2000	3380.68	111.89	378,264,285	44.200	322.00	9,576,814	133.56	216.670	28,938,445
2001	3380.68	111.89	378,264,285	44.200	322.00	9,576,814	133.56	216.670	28,938,445
2002	3380.68	111.89	378,264,285	44.200	322.00	9,576,814	133.56	216.670	28,938,445
2003	3380.68	111.89	378,264,285	44.200	322.00	9,576,814	133.56	216.670	28,938,445
Total	66538.74		4,527,887,645	897.09		112,737,357	2620.24		330,562,435

Source:
KADP
Nutrition Department of DALDO's office

Note:
(1) Unavailable prices for Sunflower, Millet and Banana for some years were simulated from vegetable prices.
(2) Price in 1984 was assumed equal to the figure in 1985.
(3) Figures between 1995 and 2003 were estimated on the assumption that the level of 1995 would continue up to 2003.

	Sunflower			Millet			Banana			Total		
	Yield (ton)	Price (Tsh/kg)	Income (Tsh)	Yield (ton)	Price (Tsh/kg)	Income (Tsh)	Yield (ton)	Price (Tsh/kg)	Income (Tsh)	Income (Tsh)	Exchange rate ($/Tsh)	Total income generated (US$)
1984	32.754	7.400	242,380	23.808	4.000	95,232	276.24	1.05	8,632,500	33,795,409	15.29	2,210,294.89
1985	32.701	7.400	241,987	58.512	4.000	234,048	418.72	1.05	13,085,000	46,551,803	17.47	2,664,671.04
1986	35.139	8.900	312,737	8.400	4.400	36,960	323.72	1.25	9,306,950	28,888,885	32.70	883,452.15
1987	32.701	11.150	364,616	40.848	6.000	245,088	405.00	1.70	12,656,250	69,437,564	64.26	1,080,572.11
1988	32.754	12.250	401,237	36.000	6.600	237,600	320.00	3.00	14,000,000	82,735,524	99.29	833,271.47
1989	46.746	12.686	593,006	35.616	7.250	258,216	378.40	3.00	24,596,000	129,840,672	143.38	905,570.32
1990	52.841	15.223	804,391	28.704	8.000	229,632	381.16	2.16	24,503,143	154,655,027	194.20	796,369.86
1991	45.050	18.267	822,948	34.176	9.874	337,464	417.20	2.59	32,184,000	245,169,193	196.00	1,250,863.23
1992	5.300	25.371	134,469	32.208	13.714	441,710	379.48	3.60	40,658,571	163,620,452	233.90	699,531.65
1993	44.626	31.362	1,399,556	35.664	16.952	604,590	193.80	4.45	29,651,400	234,455,347	335.00	699,866.71
1994	53.000	40.290	2,135,361	57.984	21.778	1,262,792	301.36	5.72	103,366,480	494,621,903	520.38	950,501.37
1995	39.485	48.550	1,916,982	38.640	26.243	1,014,031	333.12	6.89	106,264,000	422,777,156	608.99	694,226.76
1996	39.485	52.536	2,074,375	38.640	28.398	1,097,288	333.12	7.45	107,264,640	492,889,321	547.00	901,077.37
1997	39.485	61.080	2,411,756	38.640	33.016	1,275,753	333.12	8.67	107,264,640	527,731,693	547.00	964,774.58
1998	39.485	61.080	2,411,744	38.640	33.020	1,275,893	333.12	8.67	107,264,640	527,731,821	547.00	964,774.81
1999	39.485	61.080	2,411,744	38.640	33.020	1,275,893	333.12	8.67	107,264,640	527,731,821	547.00	964,774.81
2000	39.485	61.080	2,411,744	38.640	33.020	1,275,893	333.12	8.67	107,264,640	527,731,821	547.00	964,774.81
2001	39.485	61.080	2,411,744	38.640	33.020	1,275,893	333.12	8.67	107,264,640	527,731,821	547.00	964,774.81
2002	39.485	61.080	2,411,744	38.640	33.020	1,275,893	333.12	8.67	107,264,640	527,731,821	547.00	964,774.81
2003	39.485	61.090	2,411,744	38.640	33.020	1,275,893	333.12	8.67	107,264,640	527,731,821	547.00	964,774.81
Total	768.98		28,326,264	739.68		15,025,760	6793.16		1,279,021,414	6,293,560,875		21,323,692

Table 6-5 Estimated Gross Income Generated Outside the Project Area

Year	Rice Cultivation Area in K. Region (ha)	Total Rice Yield in K. Region (ton) (A)	Total Rice Yield in Project Area (ton) (B)	Net Increased Yield (ton) (A-B-Yield in 1987)	Average Price of Rice (Tsh/kg)	Gross Income Generated (Tsh)	Gross Income Generated (US$)
1984	4,416	11,437			14.70		
1985	5,092	17,096	789.19		15.00		
1986	4,836	14,914	4,239.81		19.50		
1987	4,860	**10,667**	6,179.16		27.25		
1988	6,670	24,870	8,385.12	5,817.88	30.00	174,536,400	1,757,845
1989	5,838	25,943	8,439.50	6,836.50	32.67	223,348,455	1,557,738
1990	5,766	25,943	10,659.90	4,616.10	44.33	204,631,713	1,053,716
1991	4,636	14,094	8,015.30	0.00	72.50	0	0
1992	6,889	21,381	7,120.68	3,593.32	93.75	336,873,750	1,440,247
1993	10,015	25,726	6,811.76	8,247.24	100.00	824,724,000	2,461,863
1994	9,458	30,845	3,792.65	16,385.35	117.50	1,925,278,625	3,699,755
1995	9,458	30,845	2,884.15	17,293.85	156.25	2,702,164,063	4,437,124
1996	9,458	30,845	5,370.91	14,807.09	175.00	2,591,240,750	4,737,186
1997	9,458	30,845	5,370.91	14,807.09	175.00	2,591,240,750	4,737,186
1998	9,458	30,845	5,370.91	14,807.09	175.00	2,591,240,750	4,737,186
1999	9,458	30,845	5,370.91	14,807.09	175.00	2,591,240,750	4,737,186
2000	9,458	30,845	5,370.91	14,807.09	175.00	2,591,240,750	4,737,186
2001	9,458	30,845	5,370.91	14,807.09	175.00	2,591,240,750	4,737,186
2002	9,458	30,845	5,370.91	14,807.09	175.00	2,591,240,750	4,737,186
2003	9,458	30,845	5,370.91	14,807.09	175.00	2,591,240,750	4,737,186
Total		**500,521**	**110,284.50**	**181,246.96**		**27,121,483,006**	**54,305,776**

Source: KADP

Note: (1) Net increase in rice yield = Total rice yield in Kilimanjaro region in year N
- Total rice yield in Kilimanjaro region in 1987 (10,667 ton)
- Total rice yield in the project area in year N

(2) Figures between 1995 and 2003 were estimated on the assumption that the level of 1994 would continue up to 2003.

Table 6-6 Economic Analysis of the KADP Project

	Total Japanese Inputs(US$)	Total Tanzanian Input(US$)	Total Inputs by both GVTs(US$)	Total Income from Rice Production in Project Area(US$)	Gross Income from Upland Crops in Project Area(US$)	Gross Income Generated from Net Rice Increase Outside Project Area in K. Region	Total Income Generated from Project (US$)	Net Income
1980	3,422,112		3,422,112					(3,422,112)
1981	4,478,872		4,478,872					(4,478,872)
1982	1,039,708	17,740	1,057,448					(1,057,448)
1983	1,371,583	21,673	1,393,256					(1,393,256)
1984	4,134,934	2,016,868	6,151,802		2,210,295		2,210,295	(3,941,507)
1985	8,860,271	2,597,356	11,457,628	677,610	2,664,671		3,342,281	(8,115,347)
1986	7,758,113	1,436,699	9,194,812	2,561,120	883,452		3,444,572	(5,750,239)
1987	4,214,608	302,019	4,516,628	2,621,826	1,080,572		3,702,398	(814,230)
1988	2,372,598	125,382	2,497,981	2,533,524	833,271	1,757,845	5,124,640	2,626,659
1989	5,717,022	124,773	5,841,795	1,918,003	905,570	1,557,738	4,381,311	(1,460,484)
1990	1,401,488	94,299	1,495,787	2,430,759	796,370	1,053,716	4,280,845	2,785,058
1991	779,376	197,063	976,439	3,006,449	1,250,863	0	4,257,313	3,280,874
1992	1,405,342	51,778	1,457,120	2,851,771	699,532	1,440,247	4,991,549	3,534,429
1993	41,306	31,272	72,578	1,887,581	699,867	2,461,863	5,049,310	4,976,732
1994	339,147	6,710	345,858	845,665	950,501	3,699,755	5,495,921	5,150,064
1995	368,034	5,734	373,768	732,396	694,227	4,437,124	5,863,747	5,489,979
1996	318,645	6,384	325,029	1,718,298	901,077	4,737,186	7,356,562	7,031,533
1997	288,113	6,384	294,497	1,532,344	964,775	4,737,186	7,234,305	6,939,807
1998	288,113	6,384	294,497	1,532,344	964,775	4,737,186	7,234,305	6,939,808
1999		6,384	6,384	1,532,344	964,775	4,737,186	7,234,305	7,227,921
2000		6,384	6,384	1,532,344	964,775	4,737,186	7,234,305	7,227,921
2001		6,384	6,384	1,532,344	964,775	4,737,186	7,234,305	7,227,921
2002		6,384	6,384	1,532,344	964,775	4,737,186	7,234,305	7,227,921
2003		6,384	6,384	1,532,344	964,775	4,737,186	7,234,305	7,227,921
total	**48,599,386**	**7,080,439**	**55,679,825**	**34,511,409**	**21,323,692**	**54,305,776**	**110,140,877**	
15% discount	**24,073,884**	**3,874,214**	**27,442,765**	**12,180,958**	**8,154,378**	**14,970,078**	**35,305,414**	
12% discount			**30,912,909**	**14,354,098**	**9,354,925**	**18,595,926**	**42,304,950**	

Cost Benefit Ratio(15%) 128.7%
Cost Benefit Ratio(12%) 136.9%

Economic Internal Rate of Return 8.3%

Table 6-7 Exchange Rate

	$ -> Tsh	$ -> Yen
1980	8.20	227.80
1981	8.28	221.65
1982	9.28	250.10
1983	11.14	238.52
1984	15.29	238.59
1985	17.47	239.60
1986	32.70	169.55
1987	64.26	145.67
1988	99.29	129.19
1989	143.38	139.00
1990	194.20 *	145.83
1991	196.00 *	135.52
1992	233.90 *	127.67
1993	335.00 *	112.21
1994	520.38 *	103.20
1995	608.99 *	95.10
1996	547.00 *	109.84
1997	613.38 **	121.48

Source:
(1) IMF, "International Financial Statistics"
(2) *: National Bank of Commerce, Kibo Branch Office
(3) **: Bank of Tanzania
(4) The Bank of Tokyo (TTS rate)

from which total benefits could be larger than the present estimate.

In spite of the current situation of water shortage, the KADP project is doing well be promoting the dissemination of the rice production through the technology developed and institutions established. When assessed in terms of its impact on income, employment and food supply results, it can be side that the project has been a resounding success. Even the intensified demand for the water in the project and neighboring areas might be included among indicators of success.

In reality, the new water resources were already discovered and will be available to the project area covering 2,300 ha for sure, making double cropping possible in the near future. New water resources will even make possible to cultivate in the neighboring 1,600 ha and another 2,100 ha new farm land. This possibility increases the project accountability and sustainability.

Finally, the following four qualitative points can be concluded which contributed to strengthening the effectiveness of the project.

(1) The financial and technical cooperation from Japan was fully put to use in the local production of rice and contributed enormously to increasing the household income of farmers.

(2) The Tanzanian government has made considerable self-help efforts, despite the economic plight of the nation.

(3) The project motivated the poorest farmers and contributed enormously to regional agricultural development.

(4) Irrigated rice cultivation in Lower Moshi area was disseminated as a model technique throughout the Kilimanjaro region, and has a great potential for further dissemination throughout Tanzania as a whole.

In conclusion the KADP project supported by the integrated cooperation of aid schemes from Japan has demonstrated that Japanese cooperation in this project was instrumental to enhancing local development, with due accountability:

6-2 Elements for Success

As observed above, the integrate Japanese cooperation resulted in enormous income generation. This aid scheme explains the elements for success as outlined below:

(1) Concentration of aid resources

Total amount of Japanese cooperation amounted to Yen 9,168,522,000 equivalent to US$ 48,599,706 from 1978 to 1998. This cooperation consisting of Yen 3,300,000,000 of loan, Yen 2,962,000,000 of capital grant aid Yen 2,906,522,000 in the form of technical cooperation was invested on the area of 2,300 ha for 19 years. The amount invested per ha reached Yen 3,986,314, which is equivalent to US$ 21,130. The average annual investment per ha becomes Yen 209,806 and US$ 1,112. With this amount of resource concentration, it become possible for farmers' household incomes, food supply and the creation of jobs to increase.

(2) Inter-linkage of aid programs

There was an excellent integration of the three different aid schemes, which were well inter-linked with each other. Without irrigation and tractors technical know-how could not have achieved the intended productivity. Without technical know-how the irrigation systems and tractors could not have achieved the intended higher yields. Without rice mills, farmers could not have gained the higher income. Power supply to Lower Moshi area from other project also enabled the rice mill to function properly. These inputs are all essential to the overall production for realizing the higher income of poor farmers. Inter-linkage of the necessary facilities and know-how was there in a well integrated manner in the KADP project.

(3) Accumulation of human/productive capacities

After replacing KADC, KADP trained 292 extension officers, 242 farmers and 247 operators and supervisors of tractors and other agricultural machinery, totaling 781 persons over 14 years. As a result, 781 trained personnel together with KADP staff constituted a vital element of accumulated human capacities that acquired know-how related to rice cultivation. They in turn disseminated their know-how to other farmers who motivated by rising income throughout the Kilimanjaro region, utilized the available productive capacities of irrigation systems, tractor hire services, and rice mills.

Resource concentration, inter-linkage of programs and accumulation of human and productive capacities are essential elements for success of the KADP project. These

three elements brought about the real breakthrough from poverty to better lives of the villagers. There are few case of technical cooperation in which farmers as beneficiaries could meet their basic needs and save enough money to improve their living conditions in regard to housing, education, health, etc.

It is also note-worthy how the poor farmers could improve upon the impoverished situation in the KADP project in Lower Moshi. Four factors are identified in regard to poverty alleviation:

(1) Income generation

It was clear that many poor farmers have got new opportunities for income generation through the project, by cultivating rice, a cash crop. Most farmers could gain new income 6 times as large as the previous income.

(2) Creation of employment

Rice production in the KADP project created over 1000 new jobs in the project area and over five thousand jobs in the Kilimanjaro region, particularly for women who became new wage workers from the unpaid workers before. Women rice growers are now getting more organized and more empowered.

(3) Fair opportunity for the target population

In the KADP project 781 people were given fair opportunities for training. Here, farmers inside and outside the project could receive the training in order to strengthen individual capacity of skills and knowledge. The fair opportunities for the target group to participate in training activities are credited for having given farmers more incentives.

(4) Securing access to resource and services

In the savanna climate, access to water resources is crucial to farmers. Through the construction of irrigation facilities, this project gave farmers access to water. The extension services were made available to farmers inducing those outside the project area. This further accelerated the expansion of rice cultivation. Tractor hire services were also made available to farmers to plough the farm land belonging to members of cooperative organizations. This access to critical resources and services is not often easily available to farmers.

The KADP project which had resources concentration, inter-linkage of programs and the accumulation of human / productive capacities, surely achieved the fulfillment of the four factors for poverty alleviation: income generation, creation of employment, fair opportunities to the target group, and secure access to resources and services.

7 Lessons Learned

Sustainable agricultural development is one of the most important development objectives in Africa. Many factors contribute to the achievement of this objective. Long ago, Rosen stein Roden spoke of the “Big push”, being essential to make development possible. In the KADP project, there seems to have been such a push through resource concentration. The irrigation system, rice mill and human development could meet farmers’ needs in the Lower Moshi area. Many people in the targeted population were among the poorest who migrated from outside the area. There were some exceptional farmers who were rich but average farmers own only 0.4 - 1.0 ha. Their only source of income was limited to growing upland crops in the rainy season. Annual income was too low to sustain their lives and confined their lives to small huts. As a result of the project, they have moved into block-made houses with colgated iron roofs. No doubt, poor farmers’ benefits are highly evident. The lessons learned from the project are summarized as follows:

(1) In order to achieve sustainable agriculture and realize the breakthrough from poverty, it is important to satisfy the necessary conditions for the success of a project such as resource concentration, inter-linkage of programs and the accumulation of human / productive capacities.

(2) Poverty alleviation could archived by fulfilling income generation, employment creation, fair opportunities to the target group, and securing access to resources and services. Three elements for success in the KADP project could fulfill these requirements. Income generation resulting from the project surely had the impact of giving greater incentives to many poor people.

(3) Of particular importance is institution building premised on civic organizations and increased management capacity. Management of farmers cooperative is the key to sustainability for the future.

(4) In savanna climate, rice production based on irrigation needs to maintain an optimal size of farming in terms of cultivated land vi-sa-vi the amount of water available.

(5) It is important to note that irrigation system in the savanna climate need to include measures to prevent malaria and schistosomiasis.

(6) Surplus income can induce the development of Entrepreneurship among farmers as they being to invest in businesses other than agricultural production.

(7) There is a possibility that rice production based on irrigation systems may cause positive and negative ecological changes. Positively, it might bring about “greenification”, but negatively it might lead to increased salivation, etc. These side - effects create a need of more careful studies.

8 Conclusion

The KADP project is good news for African development. It was found that the project contained numerous policy implications applicable to the continent's transformation in the areas of food security, poverty alleviation, income generation, women's empowerment, environmental conservation, and capacity enhancement. However the project also had a few negative impacts which will need to be addressed.

The KADP evaluation conducted by the joint team of JICA and CIDA met the following three objectives:

(1) To draw lessons from KADP for future sustainable agricultural development in the Kilimanjaro region, and later to apply the lessons to other parts of Tanzania and throughout Africa;

(2) To assess the accountability of KADP as a basis for promoting better understanding of development issues among the general population of Japan;

(3) To share JICA's experience in Africa with other donor agencies and to provide Tanzania and other Africa countries with feedback of donor's perspectives on the bilateral and multilateral development partnership.

The most positive impact of the project is the remarkable increase in agricultural production, employment, and increased household income. Through an on-going feed back mechanism a system of project operation was established and training courses were planned and delivered. This training which spans agricultural production techniques, as well as water management is the key to the sustainability of the project. In this sense it is not a project in which a donor comes in, carries out a funtion and departs. This project can be seen to some extent as a capacity enhancement project, where skills are transferred even to the extent that trainers are trained.

The KADP project has dramatically changed people's lives for the better. Basic human needs are being enhanced as employment opportunities are generated both in the project area and the surrounding area. Housing has improved, diets have been improved and general health of the area is improved. Partly as a result of the increased income opportunities more children are presently able to attend school.

The water shortage situation was noted by the Japanese experts working on the project, and JICA immediately began to design a plan to expand the supply and thus increase the acreage under irrigated cultivation. It was difficult to predict, given the success of the project farmers, that the producers outside would readily adopt the improved varieties and technologies. Looking at it from this point of view makes the constraint a compliment.

The negative impact of the project is the need for improving the general health conditions of the region regarding malaria, and schistosomiasis. The Kilimanjaro Agricultural Training Centre (KATC) is promoting community protection measures by reducing the breeding beds of host snails and mosquitoes, as well as the building and utilization of community toilets in the field. It has been proposed that the project establish collaborative relations with the local research institutions and CHAWAMPU. The personal protection measures such as protective housing, use of insecticide impregnated nets, and utilizing safe water are all measures promoted by the project staff.

The evaluation of the KADP technical cooperation project necessitated the counting of the inputs of Yen loan and capital grant aid, in assessing the impact, sustainability and accountability. This is due to the fact that these three related aid schemes were provided in an integrated manner, complimentary to each other, thus none of the three schemes could be evaluated independently.

The application of the correct amount of resources together with Tanzania's self-help efforts have combined to make this project a success. The lessons learned make dissemination of the KADP technology possible, not only within Tanzania but also in other Southern African countries. It is only when two governments, like Japan and Tanzania are so like-minded that the resulting partnership makes such a positive impact on people's lives.

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