3.2 Project formulation

3.2.1 Background

(1) Profile of El Salvador

Located on the Pacific coast of Central America, El Salvador has a population of 6,400,000 and land area of 21,000 square kilometers. Its neighbor to the west is Guatemala and to the north and east is Honduras. El Salvador's GNI (Gross National Income) is $2,110 (2003) and the life expectancy is relatively high at 70.1. Economic growth has marked 2 to 3% in recent years.

Table 3-2. Economic Indicators of El Salvador

Series Name	1998	1999	2000	2001	2002
Agriculture, value added (% of GDP)	12.1	10.7	10.1	9.4	8.7
Industry, value added (% of GDP)	28.2	29.1	30.2	29.5	30.2
Services, etc., value added (% of GDP)	59.7	60.1	59.6	61.0	61.0
Employment in agriculture (% of total employment)	25.1	..	..	..	..
Employment in industry (% of total employment)	24.6	..	..	..	..
Employment in services (% of total employment)	50.4	..	..	..	..
GDP Growth Rate	3.5	3.4	2.0	1.7	2.1

Source : World Bank, World Development Indicators

Although agricultural sector accounts for approximately 10% of El Salvador's GDP, the share is declining. While the industrial sector is rapidly increasing, the service sector accounts for approximately 60% of the whole. Although recent data on employment by the agricultural sector are not available, it accounted for approximately 25% of total employment in 1998.

(2) Project background

El Salvador launched a program to distribute lands to demobilized soldiers and refugee returnees as a facet of national and social reconstruction in 1992 when the civil war that had lasted for 12 years ended. It has then become important for these new farmers, who had no farming experience, to establish stable farm household economy by providing them with training in agricultural technology. It has also been necessary for the El Salvadorian government to provide existing small-scale farmers, who have been unable to escape poverty due to lack of capital or technology, with training in agricultural technology. Most farming takes place on slopes. Therefore, ensuring stability of farming on slopes has been an issue for the government. As El Salvador imports inexpensive produce from abroad, the nation's food self-sufficiency has dropped to around 50%.

In response to these social needs, the El Salvadorian government founded CENTA (Centro Nacional de Tecnologia Agropecuaria y Forestal) in 1993 with the support of World Bank to provide agricultural technology services to medium- and small-scale farmers. Due to subsequent personnel cutbacks, however, the government needed to promptly implement measures to maintain and improve the research and extension functions into the future. In this context, the government requested Japan for technical cooperation to maintain and improve research and extension function.

Since the civil war ended in 1992, Japan has provided El Salvador with non-project grant aid and various other forms of aid to support reconstruction. Concerning technical cooperation, Japan Overseas Cooperation Volunteers (JOCV) were dispatched in fiscal year 1994, then an individual expert was dispatched from fiscal year 1996. Later, three technical cooperation projects were formulated according

to the Japanese government's policy to support the reconstruction of El Salvador. This project is one of those three, and the other two are the Project on the Aquaculture Development in Estuary and the Project for Strengthening of Nursing Education.

3.2.2 Project formulation

The request received from the El Salvadorian government emphasized the need to support returnees who began farming on slopes. In the preliminary study, however, it was found that the problem with returnees was being resolved (former guerillas have already returned to their own villages) and CENTA is not offering any program catering specifically to returnees.

At the time, JICA implemented its technical cooperation projects in simple forms that focused on individual fields such as productivity improvement or research and development. JICA then began to question whether it should provide cooperation that better suits farmers, or cooperation that considers the entire farm management of farmers. To this end, a council to consider the farm management and an effort to design cooperation within this framework was begun. On the other hand, structural adjustment was under way in LDCs, so in many countries the government could no longer support the research and extension. Therefore, even if technical development was conducted, the output was not conveyed to farmers. Because of these two points, critics argued that conventional form of cooperation would not be feasible.

Due to these circumstances in El Salvador and the view of the Japanese side, the emphasis of the project was placed on boosting the functions of CENTA, or on what functions and roles CENTA should play in the new framework of agriculture. This is the basis for designating the project purpose, to strengthen CENTA's capacity to develop and disseminate techniques for sustainable farming systems to small-scale farmers. In this respect, this project is not directly aimed at extension. As a specific direction for reinforcing the functions of CENTA, "improvement of extension and training systems" and "improvement of farming system" were proposed.

3.2.3 Selection of implementation agency

CENTA, the implementation agency of the project, is an organization made up of units that handle experimenting and research and those that handle extension concerning agriculture, livestock, and forestry. The organization's roles are to help small- and medium-scale farmers located in various types of agricultural environment in the country increase income, use natural resources in a sustainable manner, and protect the environment. CENTA was formed in 1993 when Agricultural Extension Department (established in 1953) and Agricultural Technology Department (formed in 1957) were merged. In the beginning, there were 77 extension offices around the country. Since then, extension offices have been cut back pursuant to organizational changes. In 1999, when this project was launched, there were CENTA headquarters, four technology development centers, and 61 extension offices. Personnel were reduced to 64 researchers and 415 extension officers[1]. Organizational changes were made even during the project. Extension officers were reduced to 25 and extension officers to 190[2]. Due to the reduction of extension offices, areas where extension offices were closed were covered by other extension offices and areas where NGOs or other donors engaged in small farmer support activities were covered by those organizations. As the two extension offices that served as the model sites were not subject to the reorganization, this project

[1] JICA, Consultation Report of the Project for the Strengthening of Agricultural and Technology Development and Transfer in El Salvador, April 2002, page 49 (In Japanese).
[2] JICA, Evaluation Report at Project Completion of the Project for the Strengthening of Agricultural and Technology Development and Transfer in El Salvador, October 2003, page 31 (In Japanese)

was not affected by the reorganization.

As can be seen from its evolution, CENTA does not have sufficient budget to engage in activities, despite being the only institution responsible for research and extension in the agricultural field in El Salvador. For example, CENTA's budget is only 0.02% of the GDP (according to the Minister of Agriculture and Livestock)[3], which is far less than the Latin American average (0.1% to 0.15%). CENTA's budget as a percentage of the central government's budget fell from 0.28% in fiscal year 2002 to 0.18% in fiscal year 2004.[4] (The share of Ministry of Agriculture and Livestock's budget as a percentage of central government budget also fell during the same period from 1.6% to 1.2%.)

3.2.4 Purpose and project activities

(1) Purpose and activities upon planning

According to project personnel whom we interviewed, the initial purpose of this project was to improve the agricultural production technology of small-scale farmers (through the improvement of CENTA's functions), optimize the use of limited land, diversify agricultural production, and produce food consistently. Then, the farmers could sell any surplus on the market and earn some cash income. In essence, the project's emphasis was more on promoting the self-sufficiency of farmers. The project covered ten basic crops and vegetables, and many activities were scheduled when the plan was first formulated. According to the detailed Tentative Schedule of Implementation (dTSI), the project activities are as shown below.

Cultivation

1) Investigate farming systems at model sites to grasp the current conditions and problems of farms and farming systems
2) Study and plan farming systems suited to each model site
3) Improve existing cultivation technology and implement and study new cultivation technology

Target crops	Basic crops	Corn, frijoles, rice
	Vegetables	Tomatoes, cucumbers, green peppers, pipian (similar to zucchini)
	Special crops	Guisquill, loroco

4) Verification and demonstration of cultivation technology suited to the area
5) Evaluation of method of improving farming system implemented at the model site

Extension

1) Create a farm management improvement and extension plan for the model sites
2) Extend farming system to key farmers
3) Nurture and reinforce farmer organization
4) Extension activities using demonstration farms and audio visual equipment
5) Evaluation of extension technique used at model sites

Training

1) Create training plans catering to researchers, extension officers, and key farmers
2) Create training tools
3) Hold training and seminars
4) Evaluate training method

The project called for building three farming models, each for extremely small-scale farmers, small-scale

[3] Since the GDP of 2003 was $13,088 million (IMF), CENTA's budget is 0.04% of the GDP.
[4] Based on a hearing of Director General of Budget Bureau, Ministry of Finance

farmers, and medium-scale farmers.

(2) Purpose and activities during the project

In a presentation that the mission received at CENTA, the purpose of the project was stated as "reinforcing the capacity of CENTA" and "increasing the income of small-scale farmers." In fact, the project included activities with strong emphasis on increasing the income of small-scale farmers. A target disposable income for small-scale farmers was set, and measures to realize the income (such cash crops as vegetables and local crops) were implemented. It appears that CENTA put an emphasis on extending technology on selling vegetables on the market, over the emphasis on ensuring self-sufficiency of farmers. It appears that, compared to the initial plan, CENTA engaged in activities that prioritized the economic aspect.

In terms of cooperation considering farm economy, it can be said that the views of farmers were sufficiently incorporated into the project as CENTA conducted a series of farm household survey, and provided cooperation that emphasizes the economic needs of farmers. As for models for specific farming types, as a result of a farm household survey, it was found that there is little difference between small-scale farmers who farm mountain slopes. Therefore, instead of developing models for three types of farmers, a farm management improvement plan for 20 key farmers was prepared.

3.2. Selection of model sites

To select the model sites, JICA studied seven candidate sites, including six proposed by the El Salvador side, and considered safety against crime, distance from CENTA headquarters and San Salvador (capital), location, farming practices, and proximity of urban areas. As a result, Zapotitán and Cojutepeque were selected. Irrigation had been developed in Zapotitán with Japanese assistance. One of the reasons that Zapotitán was selected was the intent to provide farmers with support within the scheme of the irrigation. As Zapotitán is a low-lying area, Cojutepeque was selected as a contrasting area. In Zapotitán, however, a slope area was selected for the project, and not an irrigated area.

The elevation of both model sites is approximately 700 m above sea level (CENTA is 400 m, and farmers are located between 400 and 900 m). Average annual temperature is 23℃ and there is only about 1.5℃ of seasonal variation in temperature. Climate ranges from rainy season (May to October) to dry season (November to following April). The natural conditions of the model sites for cultivating vegetables are inferior to those of neighboring countries such as Guatemala and Honduras that export vegetables to El Salvador. On the other hand, public transportation to the model sites is superior to that in other LDCs, offers inexpensive fares, and provides good access to urban areas. Means of communication are also available at the model sites. On the other hand, gasoline is relatively expensive (approximately ¥65 per liter (as of May 2004)).

3.3 Project implementation

3.3.1 Understanding the current status

In the project, a farm household survey was conducted among 646 farming households to grasp the current situation of farmers. The information obtained in the study proved to be crucial, as it was used to select key farmers and provided basic information for the project's activities. The farm household survey provided a clear picture of the average farmer in the area. According to the study, most of the farms are on slopes, some of which are at a 35-degree angle. The farms range in size from 1 to 2 ha, and produce

the basic crops (staples) of corn and frijoles. Many of the farms each keep one or two pigs and approximately ten chickens. In addition, some farms have a few citrus fruit trees. Farm equipment is limited to such small tools as manual sprayers (used primarily for spraying herbicide), machetes, sowing sticks, and hoes. Since the farmland is steep, it cannot be plowed (if plowed, the surface soil would be washed away by rain).

While the literacy rate of farmers is 70% or less and farm income is less than $1,000 per year, annual expenditure (household and farm expenditure) is approximately $2,000. To make up for the difference, farmers work at sewing plants in the area, work at coffee or sugar cane farms in the dry season, or depend on money from their relatives who live abroad (an estimated 2 million El Salvadorians live in the United States). Gross income of farmers based on the farm household survey is shown below. The income includes wages earned by working on other farms and non-farm wages.

Income Level	Ratio
Income＜1,147 ドル	29%
1,147 ドル＜Income＜2,294 ドル	33%
2,294 ドル＜Income＜3,440 ドル	16%
3,440 ドル＜Income＜4,587 ドル	8%
4,587 ドル＜Income	14%

Although the project initially intended to interview 800 farmers in the farm household survey, only 646 were actually interviewed. Since it took one year to conduct the survey, the project activities were actually limited to four years.

3.3.2 Selecting a target group

A middle-income group among the small-scale farmers was selected as the primary target group. The middle-income group was selected because high income farmers did not fit the purpose of the project and low income farmers did not have the capacity to challenge something new. In general, however, there is little difference in income between farmers.

3.3.3 Selection of crops and technologies

(1) Focus on vegetables and local crops

As stated earlier, a wide range of activities were initially planned for project. As it would have been difficult to complete all the activities in five years (actually four years, since one year was required for the farm household survey), the activities were narrowed down. Research and extension of basic crops (corn and frijoles) were included in the activities, but CENTA received new variety candidates of corn from CIMMYT (international research institute in Mexico). As CENTA has already actively conducted research on corn, the research and extension of basic crops were changed from primary activities to subsidiary activities.

Construction of terraces to hold soil on slopes was one of the output indicators of Project Design Matrix. As a project by another donor had already addressed this problem, and since extension officers and farmers alike had the know-how, it was deleted from the output indicator of the project.

As a result of the farm household survey, it was found that farmers desired cash income, and wished to grow vegetables, special crop (loroco), and fruit (papaya). On the other hand, due to lack of research budget, CENTA conducted very little vegetable cultivation research. Taking into account these findings,

as well as the fact that there were two Japanese technical experts for the project, the project chose vegetables as the primary activity field for the project.

(2) Focus on three vegetables (tomato, green pepper, and cucumber)

Although the farmers at the model sites had attempted to produce tomatoes, they had experienced a major setback when their crop was infected with a virus transmitted by whiteflies (common among Central and South America). As tomato is the most difficult vegetable to cultivate, if the farmers could grow tomatoes, they could use the technology to cultivate other vegetables. In addition, tomatoes are a cash crop whose demand is consistent, there was no active production of tomatoes in El Salvador, and 80% of the tomatoes consumed in the country were imported from neighboring countries. Due to these reasons, the decision was made to set priority on developing technology primarily for tomatoes. In order to improve the efficiency of activities, the project focused on tomatoes, green peppers, and cucumbers.

(3) Development and implementation of 13 basic techniques

The technology that was developed can be divided into the thirteen components below. Each technique could easily be learned by farmers with training and hands-on practice.

1) Selecting disease-resistant and high-yielding vegetables and basic grains
2) Growing healthy seedlings using a simple greenhouse
3) Making simple nursery bed using locally available materials
4) Nursery technique using trays and pots
5) Planting density
6) Improving fertilization method
7) Using organic fertilizer (chicken manure)
8) Pruning technique
9) Pest control
10) Grass mulch
11) Using water storage tank to extend cropping season
12) Drip irrigation system to extend cropping season
13) Cultivating without plowing (prevent soil erosion on slopes)

The techniques introduced through the project have been popular among families (especially women). In the past, only men worked on cultivating vegetables. As the new techniques are labor intensive, they require numerous manual tasks. Therefore, everyone in the family now works on growing vegetables. As a result, many farmers (especially women) report that family bond has been strengthened through vegetable cultivation and the use and sale of produce.

(4) Inputs and infrastructure required for production

One of the points that may affect the dissemination of the technology is that the vegetable cultivation technology implemented in the project requires relatively expensive infrastructure materials (greenhouse, water tank, and drip irrigation system) and input (seeds, fertilizer, and agricultural chemicals). These factors are described below.

1) Input

The input required for the vegetable cultivation recommended by the project is relatively expensive. In

the case of tomatoes, the input costs $216 per 0.1 ha[5]. The high cost of input can be attributed to the oligopoly of imported fertilizers and agricultural chemicals. Their prices are 20% higher than they are in neighboring Guatemala. Some of the input cannot be purchased in small quantities, but must be purchased in bulk. As a result, purchase of the input is one of the constraints. In fact, extension officers in Cojutepeque pointed out that 80 to 90% of the farmers in the area (of jurisdiction of the extension office) are unable to purchase the input necessary for vegetable cultivation. Many of the key farmers and intermediate farmers whom the study mission interviewed pointed out that it is difficult for them to purchase input because of the high cost.

On the other hand, Japanese experts of the projects feel that the purchase of input is not a major constraint because:

- Even conventional corn production requires about $20 per 0.1 ha for the purchase of input[6]
- Vegetable cultivation of 0.1 ha is the final size that the project aims for, and the farm is begun on a smaller scale. Therefore, the input would not cost $200.
- It is possible to cultivate vegetables even if not all of the recommended inputs are used.

On the problem of large purchase lots for the input, too, experts point to the fact that farmers have jointly purchased fertilizer for corn, so they can do the same for vegetables. The project is also promoting group activities with the aim of introducing group buying.

2) Infrastructure

Greenhouses are essential facilities for protecting vegetable seedlings from diseases and insects. The use of a greenhouse constitutes the foundation of the vegetable cultivation technology introduced by the project. JICA provided two Israeli-made greenhouses, each valued at approximately ¥2 million, for CENTA to be used to train researchers and extension officers, and small handmade greenhouses for key farmers for training. A greenhouse can be shared by multiple farmers. In fact, the project gave greenhouses to key farmers on the condition that they be shared with other farmers. Today, vegetables are primarily cultivated using these greenhouses during the rainy season. Whereas tomato yield was approximately 1 ton per 0.1 ha using conventional techniques, the improvement of cultivation technology through the project resulted in a yield today of 4 to 8 tons. One drawback is that these greenhouses are expensive. While cost varies by size, a greenhouse of the same size that was implemented for demonstration in the project costs approximately $1,000. One major cause of the high cost is that net is much more expensive than it is in neighboring countries.

In a questionnaire of twenty key farmers, sixteen pointed to the high initial capital outlay as an impediment to dissemination. Therefore, the project is working to reduce the cost of infrastructure. One idea is a simple greenhouse using bamboo for the frame. In addition, although the price of infrastructure materials is high compared to the farm income of farmers, the cost required for a greenhouse can be recovered by producing one crop of 0.1 ha of tomatoes during the dry, Christmas season (profit of $1,155 per crop)[7].

In El Salvador, farming activities normally begin in May, the beginning of the rainy season (May to

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[5] Project for the Strengthening of Agricultural Technology Development and Transfer in El Salvador, Farming Technology: Crop Cultivation Techniques, November 2003 (In Japanese)

[6] Project for the Strengthening of Agricultural Technology Development and Transfer in El Salvador, Summary of the Current Status of Farmers in Model Sites, March 2000, page 6 (In Japanese)

[7] In the farming model of the project, the depreciation costs of the greenhouse, water tank, drip irrigation pipe and hose are calculated on the assumption that their service lives are 5 years, 10 years, and 3 years, respectively.

October). As a result, harvest is shipped at once in August, so selling price drops and farmers make little profit. El Salvador is warm throughout the year, its temperature varies little, and cropping season can be extended provided water is available. The project recommends farmers to cultivate year-round. In particular, the project aims to produce agricultural products during the dry season (November to April), when prices are high, and sell during the Christmas season when prices peak. To extend the cropping season, the project has recommended the development of irrigation facility. The cost is approximately $500 for the purchase and installation of a water tank and approximately $300 for a drip irrigation system. Cost reduction efforts can also be seen for these infrastructure items. For example, the simple water reservoir uses vinyl sheet and the handmade drip irrigation system uses inexpensive hose. In addition, where a well is available, it is possible to install an even less expensive irrigation system. Even during the rainy season, there may be a dry spell of about two weeks in length, which can cause a major damage on vegetable cultivation. In this case, the use of grass mulch (prevents mud from splattering on vegetables and prevents diseases) and water reservoir could be beneficial even when cultivating during the rainy season.

3.3.4 Outline of project activities

This project was composed primarily of the three activities, which are described below.

(1) Technology development

Tests and demonstrations were conducted at the experimental farm and demonstration farm for the six high priority issues (variety selection, nursing technology, protection of crops from diseases, fertilization method and soil control, irrigation techniques, and other useful cultivation techniques). The relationship between research and extension is such that it is generally believed more practical to take the two-step approach of first developing the technology, then extending the technology in the next step. In this project, however, the two steps were taken at once. Since the period of cooperation was limited, the extension had no time to wait for the technologies to be developed. Therefore, the improvement and development of the technology were conducted at the same time. Key farms were selected as demonstration farms. Technology development and extension cooperated in developing and demonstrating techniques, which at the same time served as exhibition and extension. As a result, in certain cases, a technique developed through extension activities in advance was examined by researchers. Through such collaboration, many practical techniques were improved and developed.

(2) Extension

Extension officers cooperated with researchers to develop, and demonstrate techniques suited to extension. In addition, extension officers engaged in joint activities with the training department to extend technology to farmers. Extension officers installed and demonstrated a simple greenhouse, water tank, and water reservoir, water-conserving irrigation method using a drip irrigation system, and the cultivation of vegetables at twenty key farms. By 2003, cumulatively 268 demonstration farms were set up. In addition, they extended technology to 400 intermediate farmers grouped around key farmers, assisted group activities, provided training to children of farmers through school garden programs, and engaged in such gender activities as home gardening and simple food processing training that catered to women in rural areas. Furthermore, in extension activities, extension officers used such audio-visual equipment as Power Point to improve the extension effect. As for improvement of farming management, the extension officers have formulated a 5-year farm management improvement plan at each key farm.

(3) Training

The training department reduced classroom lectures, and shifted to more practical training with the mottoes of emphasizing the field and hands-on experience. The training department provided various training programs to the counterpart, CENTA researchers and extension officers, key farmers, intermediate farmers, farmers' children (school students), and women at CENTA's seminar rooms, hands-on work area, demonstration farms of 20 key farmers, and farms of other farmers. The training department also eagerly responded to requests for training from areas outside of the model sites. To also use the improved or developed techniques as training tools, the training department also produced videos in addition to the manuals described above. The training department also used audio-visual tools from flip charts to Power Point in training.

The authority to prepare, implement, and evaluate training program is always in the hands of the counterpart. The activities of the training department have taken root. Table 3-3 shows the training programs carried out over the last three years (training courses include study tour (Gira), participation in open house at a farm (Dia de Campo), participation in farming system presentation (Dia de Logros), workshops, etc.)

Table 3-3 Traning courses and participants implemented at CENTA

Year	CENTA Technicians	Farmers	Others
2000	5 (40)	9 (73)	
2001	8 (33)	20 (577)	3 (55)
2002	12 (59)	71 (905)	6 (120)

Source: JICA, Evaluation Report at Project Completion of the Project for the Strengthening of Agricultural and Technology Development and Transfer in El Salvador, October 2003, page 17 (In Japanese)

Note: Numbers in parenthesis are the number of courses

3.3.5 Reinforcing the capacity of CENTA

This section discusses the institutional, technical, and financial aspects of how the project reinforced the capacity of CENTA.

(1) Institutional aspect

1) Project positioning within CENTA

As the project was given a more or less independent position within CENTA, the project had a relative autonomy over the spending of activity expenses, assignment of personnel, and selection of activities. This autonomy led to the smooth implementation of the project. On the other hand, the collaboration between the project and other organizations within CENTA was not necessarily sufficient in the beginning. As the collaboration was reinforced as the counterpart's activities got on track, however, the joint activities improved. For example, JICA provided technical guidance via short-term experts and equipment to the laboratory, which diagnoses damage from diseases and analyzes soil constituents, to ensure fruitful joint activities. In addition, to ensure that the know-how from the project's activities take root in CENTA, JICA urged CENTA researchers and extension officers other than the counterparts to take part in the deliberations for formulating the vegetable cultivation training plan and producing the cultivation manual and video.

2) Selecting the counterparts

Upon commencement of the project, CENTA nominated two counterparts. These two counterparts and

Japanese experts nominated other counterparts. Researchers with experience in the vegetable field and who are willing to work actively on the project were selected. Knowledge of the local characteristics of the model sites was also taken into account. Some counterparts were called from other regions because of their motivation. As for extension officers, the existing extension officers in Zapotitán and Cojutepeque served as the counterparts. When extension offices were closed due to the reorganization of CENTA during the project period, extension officers who were in charge of vegetable cultivation at these closed offices were sometimes moved to other extension offices and became new counterparts. In order to ensure the sustainability of the output of the project, the age was also taken into account (preference was given to those aged 35 or below).

3) Number of counterparts

Two Japanese technical experts, one on cultivation and the other on extension, participated in this project. There were 27 counterparts in research, extension, and training combined. Although the extension officers could visit no more than three key and intermediate farmers a day, the large number of counterparts allowed the project to keep in touch with the farmers. An extension project should have a large number of counterparts (at least ten).

4) Collaboration and simultaneous execution of research and extension

One distinguishing feature of CENTA is its use of a research and extension collaboration system (Generacion y Transferencia de Tecnologia: GyTT) . This system is designed to reinforce collaboration between researchers and extension officers. Specifically, researchers from CENTA headquarters are assigned to extension fields to conduct tests using farms with the cooperation of extension officers and farmers. At the same time, the researchers attempt to solve the problems faced by farmers in response to requests from extension officers. This system, which had been implemented with the support of World Bank, was succeeded by the project.

The conventional flow of technical development and extension is: researcher → extension officer → farmer (solid arrows in Fig. 3-1). In some cases, however, researchers engage in technology development without considering the needs of farmers. On the other hand, the process under GyTT is, in concept, represented by the broken line arrows in the same figure. In essence, extension officers, along with researchers, establish a demonstration farm at a key farm, provide tranining on the farm. At the same time, researchers conduct vegetable cultivation experiments meeting the needs of farmers at CENTA's experimental farm. The use of this method makes it possible for technology development and extension activity to be conducted at the same time. In essence, the project did not employ the conventional method of waiting for research to develop the technology to engage in extension.

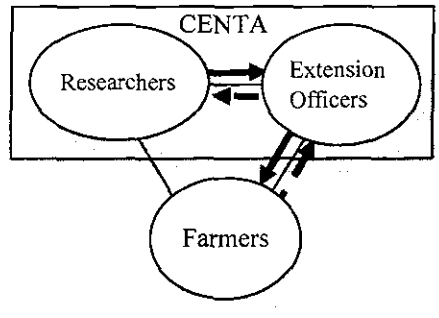


Figure 3-1 Generation and Transfer of Technology

One example of GyTT is the comparative study of several varieties of tomatoes. Although there are many tomato varieties on the market, a farmer cannot try dozens of varieties. Therefore, the demonstration farm at a key farmer narrowed down the choice to three or four promising varieties. On the

other hand, CENTA's experimental farm compared many more varieties. The tomato varieties that were selected by CENTA's experimental farm for high yield, resistance against disease, and high quality were introduced to the demonstration farm at a key farmer. In some cases, extension preceded research. For example, when extension officers achieved success in the mulch cultivation of tomatoes, researchers analyzed the technical aspects (the moisture in soil, ground temperature, and root development compared to cultivation without mulch) and generalized the technology so it can be extended to any farm. In many cases, extension officers alone could not properly diagnose damages from diseases or analyze soil constituents. In such cases, researchers provided the necessary support. As these examples illustrate, the collaboration between research and extension (farmers) was an essential part of the project.

The importance of teamwork between extension officers, researchers, and farmers was pointed out by many CENTA officers. The implementation of GyTT appears to have improved communication between researchers and extension officers. The system also helped expedite the project. The project required the vegetable cultivation technology to be improved in four years. As extension and research are advanced at the same time under GyTT, the system reduced the time requirement.

Although joint work by researchers and extension officers is ideal in terms of extension, it does have its drawbacks. For example, in more than few cases the relationship between a researcher and an extension officer may not be smooth. In addition, it is common for the two to have different educational backgrounds. One of the reasons that GyTT was possible in the project is that World Bank had conducted GyTT at CENTA, and researchers and extension officers were already accustomed to the system. In addition, in El Salvador, the difference in the wages and educational backgrounds between researchers and extension officers was not so large. Furthermore, there was already precedence for researchers and extension officers to work together. Japanese experts point out that although there may have been internal conflicts between the two parties, the joint extension activities functioned properly.

(2) Technical aspect

1) Grasping the abilities of counterparts

To Japanese experts, it is important to first accurately grasp the capacities of counterparts. To find out, the experts asked the researcher, whom CENTA identified as its most competent researcher, to grow vegetables. When the researcher failed to properly grow vegetables, the experts realized that the researchers and extension officers lack practical techniques. For example, although the researchers could name several tomato diseases, they could not identify the disease by looking at an afflicted tomato. The same problem applied to extension officers. Consequently, farmers did not trust extension officers. Even if farmers had a problem in tomato production, they never asked extension officers for advice.

2) Researcher and extension officer training with emphasis on practical skills

The training was composed of 80% hands-on training and 20% theory, thus placing a greater emphasis on hands-on training than on classroom lectures. The training for researchers and extension officers was conducted in three phases. In the first phase, Japanese experts organized the problems and narrowed down the issues. In the second phase, basic hands-on training was provided to researchers and extension officers on CENTA's experimental farm. In the third phase, hands-on cultivation training was provided to farmers, extension officers, and researchers on the demonstration farms of key farmers. By working through these phases, researchers and extension officers gained confidence in providing guidance on vegetable cultivation technology.

3) Improving the capacity of researchers

Researchers gained a more accurate understanding of the needs of farmers by visiting with farmers more often and improving communication with extension officers. As a result, their research became more attuned to the needs of farmers. Researchers also began to seek for easy, simple solutions that are more readily accepted by farmers. To convey their findings, researchers began to hold presentations on their findings to farmers.

All eight researchers who replied to the study mission's questionnaire commented that the project has strengthened their technical capacities as researchers. When asked which training was most useful in improving their capacities, everyone replied, "training on practical cultivation technology on the farm." In addition, seven researchers replied "joint work with extension officers" and five replied "communication with farmers." When asked about the advantages of jointly working with extension officers, five replied, "gaining a better understanding of the needs of farmers" and "being able to more effectively use the coordination abilities of extension officers." Four replied, "being able to use the communication abilities of extension officers." The important point is that by working jointly with extension officers, researchers became able to understand the true needs of farmers. On the other hand, when asked about the disadvantages of joint work, four replied, "the difficulty of coordination." The joint work between researchers and extension officers is also praised by farmers. Of the twenty key farmers, thirteen replied that the joint work between researchers and extension officers led to better service.

It appears that the farm household survey also played an important role. In response to a question on how researchers find out the farmers' needs, all eight replied, "farm household survey," seven replied, "visits to farms," six replied, "from extension officers," and five replied, "from Japanese experts." As only two replied, "I was well aware of the needs before the project began," it can be seen that the project has helped the researchers understand the farmers' needs.

As these answers indicate, researchers are believed to have realized the importance of conducting research that addresses the needs of farmers by working jointly with extension officers and farmers. On the other hand, the role of researchers does not stop there. It is also the role of researchers in extension to present a technical solution when extension officers come across a technical hurdle, and support the activities of extension officers and farmers' cultivation. To determine how useful researchers were to extension officers, we reviewed extension officers' answer sheets, and found such advantages as "extension officers can solve farmers' problems more quickly by working jointly with researchers" and "extension officers can present more options to farmers by working jointly with researchers." On the other hand, the extension officers are not necessarily satisfied with joint activities with researchers, as evidenced by such replies as "such functions were not actually sufficiently fulfilled," "coordination is difficult (9 out of 18), "the output of research is not conveyed to extension officers," "researchers are reluctant to visit farms," and "researchers do not understand farmers' problems." Such replies were often heard from extension officers in Cojutepeque, which is approximately two hours from CENTA. Although researchers' activities became more attuned to farmers' needs, extension officers were not fully satisfied with the improvement[8].

4) Improving the abilities of extension officers

As described above, Japanese experts provided guidance to extension officers with an emphasis on

[8] One of the reasons for this may be that there was only one researcher working at the Cojutepeque extension office. Zapotitán extension office is adjacent to CENTA headquarters where many researchers work.

practicality. Extension officers also used the experimental farm in CENTA to improve their technical skills. As a result of such activities, it is believed that substantial improvements have been made to the abilities of extension officers.

In response to a question on what abilities they improved, all 18 extension officers (two coordinators, seven Zapotitán extension officers, and nine Cojutepeque) replied, "cultivation technology." Seventeen replied, "experience on farms" and fifteen replied, "planning." An extension officer replied, "work discipline," which indicates that the experts' attitude toward work may also have had a favorable effect on a non-technical aspect of the counterparts. When asked which training was most helpful in improving their abilities, all the extension officers answered, "practical cultivation technology training on the farm," indicating that the experts' guidance with an emphasis on practicality was pertinent. Seventeen answered, "direct guidance by Japanese experts," and twelve replied, "work with farmers." Only four replied, "joint work with researchers."

In response to a question on how they determined the needs of farmers, sixteen replied, "farm household survey," which was the most popular answer as it was among researchers. Fourteen replied, "visits to farms" and nine answered, "from key farmers." Only six replied, "I knew the needs before the project began," thus indicating that even extension officers were not fully aware of the needs of farmers, and that they improved their understanding through the project.

Farmers also feel that extension officers improved their abilities. Although farmers never asked extension officers for help when they had a problem with vegetable cultivation, they now quickly turn to extension officers for advice when they have a problem. Extension officers are now able to provide more practical advice to farmers, and many of the farmers point out that extension officers have indeed improved their ability to provide technical guidance. The farmers' trust of extension officers has also surged.

5) Guidance on farm management

Farm management and vegetable cultivation technology go hand in hand. Therefore, guidance on farm management was incorporated as an important part of the project. To be more specific, a detailed farm household survey on twenty key farmers is held every year in addition to the survey that was conducted at the beginning of the project.

6) Counterpart training

In training counterparts, thorough guidance was first given Then, intensive guidance was provided to those who fall behind in the learning process. Japanese experts point out that when those who fell behind began to improve, the surrounding individuals also became active, and improved the overall level.

(3) Financial aspect

As described above, the project had relative autonomy at CENTA. As a result, expenditures concerning the project were made smoothly, and there was no fiscal impediment that impaired the project activities. However, CENTA had insufficient budget

Table 3-4 CENTA's Budget

(Million Dollars)

	2002	2003	2004
Central Government	2,504.10	2,486.70	2,793.10
Ministry of Agriculture and Livestock	40.8	29.2	34.1
CENTA	6.9	5.2	5.1
Self fund	N/A	0.2	0.2

Source: Hearing of Director General of Budget Bureau, Ministry of Finance

and was difficult for the project to use CENTA's project budget. Although CENTA made an effort to assign personnel and bear labor cost and common service expenses, it was unable to provide sufficient activity expenses. For example, CENTA paid the wages for extension officers, lease payments for motorcycles, and cost of fuel for the motorcycles ($120 per year per extension officer), but the fuel allowance was not always paid on time (Background paper for the evaluation report at project completion). In such cases, JICA paid for part of the activity expenses.

(4) Miscellaneous

Extension officers who belong to extension offices other than the model sites also had the opportunity to receive training on the technology developed by the project at CENTA. They also participated in study tours visiting key farmers.

3.3.6 Overall extension approach

This project employed farmer-to-farmer extension as the extension approach. This approach is described in detail under 3.3.7. This section explains the concept and policy of the overall extension approach under the project.

(1) Positioning and policy of extension under the project

The purpose of this project was "the functions of CENTA for the development and transfer of the techniques for sustainable farming systems to small-scale farmers will be strengthened." Therefore, extension was not a direct purpose. In essence, the role of the project is to transfer extension techniques and know-how of farm management to counterparts. The project was not designated to replace El Salvador's extension project. While extension activities cover a wide range of areas, the project apparently aimed to realize the overall goal, "the higher and more stable income of small-scale farmers will be realized through the acquisition of techniques for sustainable farming systems," by concentrating the efforts on improving the activity of counterparts. Consequently, while this project incorporates the logic for dissemination to intermediate farmers, further dissemination to other farmers is not incorporated as an element of the project.

On the other hand, the counterparts improve their extension abilities through the extension activities to farmers. The effort to reach out to farmers through extension officers was an important mainstay of the project. There are two principal policies for extending technology to farmers:

i. Emphasis was placed on instilling in farmers the desire to acquire the technology, instead of merely teaching them the technology.
ii. Generous financial support was provided for the process of the farmers learning the technology.

These policies are based on the following view of Japanese experts: The important part of extension is the process of encouraging farmers to invest. It is important for farmers and extension officers to experience through demonstration farm activities that they can recoup the cost of agricultural supplies by using new cultivation technology. If the farmers do not experience this first hand, they cannot be persuaded to voluntarily make an investment. Therefore, in the learning process, the project should not hesitate to bear the expenses. Therefore, the project provided key farmers with infrastructure materials and input on cost sharing basis. The project also paid for seeds for intermediate farmers to learn cultivation technology.

(2) Focus on technical aspect

One of the distinguishing characteristics of this project was that activities strictly on technical aspect were carried out. There is generally a series of steps after a new technology is implemented before it results in increase in farmers' income. These steps are, for example, acquisition of technology, financing the purchase of equipment and input, production, marketing, and processing. Unless this flow is consistently established, farmers do not see an increase in their income. Therefore, there are many hurdles to increase in income other than acquisition of technology. Examples include low literacy rate and the inability to read, inability to implement a new technology due to lack of capital, inability to invest any more labor into agriculture, lack of a farmers' organization, lack of market access, low farm-gate price, or expansion of gender gap due to implementation of a new technology. Because of these factors, in general various activities are often incorporated into agricultural and rural development projects.

This project focused its activities on technical aspects. There are a number of reasons for this. One is that when the project was started, there was very little vegetable cultivation, and unless the cultivation technology at the uppermost part of the flow mentioned above is acquired (i.e., production is established), providing support downstream would have little effect. Second reason is that considering the project's purpose of reinforcing CENTA's capacity, fields other than technology transfer were considered as outside the framework of the project and should be handled by the El Salvadorian government. Third reason is that incorporating too many elements at once may exceed the management capacity of the counterparts.

Such focus on the technical aspects is deemed appropriate considering the conditions that existed in El Salvador at the time the project was started. For example, when the project began to handle vegetables, there was only a marginal production of vegetables in El Salvador. Therefore, the situation was such that any vegetable that was produced could be sold on the market[9]. The model sites had excellent market access, and there was no need to pay special attention to gender in the project. In essence, in the flow of steps, production was the largest bottleneck.

The perceptions above do not make it appropriate to continue to focus on technical aspects in the future. Today, technology transfer to 400 intermediate farmers is under way. These farmers will have acquired the vegetable cultivation technology in the near future. Without some sort of outside support, however, it would be difficult for them to purchase the infrastructure (and input) such as greenhouses. Without the support, they cannot use the technology that they will have learned. Therefore, if JICA were to provide support at this point, it would be appropriate to extend credit to intermediate farmers. As these intermediate farmers have already acquired the technology to some extent, the risk that they will fail technically and become insolvent has been reduced considerably. As domestic tomato production has increased and tomato prices are falling, marketing support is another option.

(3) Farm household survey

The primary components of this project are technical guidance and evaluation of farm management. The project continuously studies the farm household economy at key farmers and intermediate farmers so changes in their economies can be immediately detected. In essence, the project not only provides technical guidance on vegetable cultivation, but on farm management. Japanese experts point out that when extension officers acquire such skills, they can calculate the finances of a farm by taking a brief look at the farm, and become able to provide more convincing guidance.

[9] Farmers usually take produce directly to a market or sell to a broker at the farm.

3.3.7 Farmer to farmer extension

In this project, technology was first transferred to extension officers, then the extension officers demonstrated new cultivation technology with farmers on demonstration farms. Next, intermediate farmers were selected, and extension officers worked with key farmers to jointly transfer technology to the intermediate farmers. This section discusses such farmer-to-farmer extension.

(1) Transfer to key farmers

1) Selection of key farmers

Japanese experts and counterparts set the selection criteria to reflect the diversity of the model sites. Based on the criteria, twenty key farmers (ten in each model site) were selected. The selection criteria are:

1) *Cropping pattern*
2) Inclination of farm (9% or less, 10 to 29%, 30% or more)
3) Availability of ground water for irrigation
4) *Gross farm income (approximately $570 to $3,400 per year)*
5) Farm area owned (at least 0.5 manzana of basic grains or at least 0.25 manzana of vegetables)[10]
6) Years of education (at least 3 years)
7) Time spent on agriculture (at least 8 hours per week)

Table 3-5. Selection Criteria and Number of Key Farmers in Each Model Site

(Unit: Persons)

Slope	9% or less		10~29%		30% or more	
Ground water / Cropping Pattern	Available	Not Available	Available	Not Available	Available	Not Available
Basic Grains Only	*0*	*0*	*0*	*1*	*0*	*1*
Basic Grains and Vegetables	1	1	2	2	1	1

Source: Project Report

The location of key farms was also taken into account to provide easy access for other farmers. The project explained to the selected key farmers their roles, such as technology transfer to intermediate farmers, and only those key farmers who agreed to the roles were certified as key farmers.

Normally, leadership is considered in selecting key farmers (e.g., KATC project in Tanzania and PAES[11]). The leadership was not, however, used as a criterion in the selection. One of the reasons for this is that the project aimed to select twenty farms with various physical farm conditions as key farmers, demonstrate the new cultivation technology under these conditions, and then extend to 400 farms only those techniques that are found to be acceptable. While the selected key farmers were expected to become group leaders, some proved to be inadequate as a leader. In this case, they were promptly replaced with other farmers.

[10] 1 manazana is approximately 0.7 ha

[11] In the El Salvador Environment Plan (PAES) supported by the Inter-American Development Bank, key farmers in farmer to farmer extension were elected by farmers.

2) Providing infrastructure and input for key farmers based on cost sharing system

Although CENTA has demonstration greenhouses, Cojutepeque is a two-hour drive, and it is difficult to frequently invite farmers to CENTA. Therefore, a greenhouse for training was first built at an extension office in Cojutepeque. Then, greenhouses were provided to all key farmers (20). Intermediate farmers were invited to the key farms for training to improve extension efficiency.

Each key farmer received infrastructure, supplies (e.g., net for greenhouse) and inputs necessary for vegetable cultivation (e.g., seeds and agricultural chemicals). Farmers also provided some supplies available locally (e.g., cement) and labor. The input of such supplies is a basic element of a new vegetable cultivation technology, as without it, it is impossible to escape the traditional, unprofitable farming method. The infrastructure and input were provided because it is important for the farmers to experience the technology themselves. The purpose of the investment is not to improve the management of key farmers, but to help them learn a new technology and change their awareness. In essence, the installation of demonstration farms is seen as an extension method of inducing key farmers and intermediate farmers to aggressively implement technology by seeing the results on the demonstration farms.

Providing only part of the rural community with materials and input may create an artificial discrepancy between the farmers. In order to prevent the discrepancy from having an adverse effect in the community, the project clearly stated to the key farmers their role (to disseminate technology to other farmers), and exchanged written agreements. In fact, some farmers declined to become key farmers despite having been selected, as they felt that the role as a key farmer was a burden and that they would have to bear some expenses.

3) Technology transfer to key farmers

First, extension officers explained the new technology to key farmers. Then, the key farmers actually observed vegetable cultivation at CENTA's experimental farm. It appears that the prior relationship between the extension officer and the key farmers affected whether the key farmers, who had bitter experience with tomato cultivation from previous experiences, believed the extension officer's explanation. If the key farmer had known extension officers well, then the key farmer promptly decided to implement the new technology. When a farmer agreed to become a key farmer, the extension officer played the central role in the technology transfer. Primary method of technology transfer is the demonstration farm, where the key farmer and extension officer jointly cultivate crops on the key farmer's farm. The demonstration farm method was employed on all twenty key farms. As the method may not be successful at all locations, the more demonstration farms, the better.

Activities on demonstration farms were extremely important as they allowed farmers to actually see and learn. For example, shaded cultivation was attempted as direct sunlight is too strong for tomato cultivation in El Salvador. Although this was a success, the shading material is expensive. Therefore, the focus was shifted from the sky to the ground, and tomato cultivation using white and black mulch was tried. This was also a success, but this material is also expensive, and is difficult to purchase in El Salvador. Therefore, the project tried materials available on a farm (e.g., corn and bean husks), and they worked better than the black and white mulch. Farmers recognized the success by seeing it with their own eyes. In addition, it is important for extension officers and farmers to understand why tomatoes grow better when grass mulch is used. Grass mulch is important because it prevents the soil from drying. To see the effect, the farmers lifted the grass mulch near the tomato root and observed the roots. Seeing the growth of strong, white roots, the farmers (and extension officers) were able to confirm the reason for the

success on their own farm.

When asked which instruction method is most effective for key farmers, 15 out of 18 extension officers replied, "technical guidance concerning vegetable cultivation" and 13 replied, "developing demonstration farms." An extension officer also replied, "I discussed crop cultivation with farmers and motivated them to cultivate vegetables, and not just basic grains." In addition, 7 replied, "provision of market information." While there was no direct support for sales, it appears that provision of market information was effective. When asked about the most difficult aspect of technology transfer to key farmers, 14 out of 18 replied, "financial limitations of farmers." Other answers include "I am not yet convinced of the validity of vegetable cultivation" and " technology transfer takes too much time." Only 3 out of 18 replied, "knowledge of key farmers is inadequate," indicating that the techniques were not too difficult for farmers to practice.

Replies from the 20 key farmers (10 in Zapotitán and 10 in Cojutepeque) indicate that key farmers have aggressively implemented technology and are gaining confidence with the technology[12]. For example, all the key farmers feel that the project has improved their knowledge and skills concerning vegetable cultivation. When asked which training method was most useful in acquiring technology, 19 out of 20 replied, "practical training in the field." In addition, 18 replied, "activities on demonstration farms," 13 replied, "joint support by researchers and extension officers," 12 replied, "knowledge on planning and management" and "lectures." As can be seen, the guidance with emphasis on practicality was widely accepted by farmers.

Key farmers visited each other's demonstration farms on study tours. Reciprocal learning between key farmers is an effective extension technique. As extension officers also participate in this study tour, it allows them to see the output of their guidance. In addition, the study tour served as grounds for friendly competition between the farmers and extension officers.

Support to key farmers was discontinued when the project switched its principal target to intermediate farmers. This was important to minimize the key farmers' dependency on the project and to verify the sustainability of the key farmers during the project period. Before support was discontinued, however, meetings were held with key farmers to make sure that the key farmers can sustain vegetable cultivation. The farmers confirmed the production materials they had prepared for vegetable cultivation. Japanese experts prepared a list of the activities and funds necessary for vegetable cultivation, created a five-year farm management improvement plan, and made it easy for farmers to make long-term forecasts.

(2) Technology transfer to intermediate farmers

1) Selecting intermediate farmers

To introduce the tomato cultivation, it is necessary for farmers to form a group in order to, e.g. buy inputs. As farmers in El Salvador had little experience in organized activities, the project instructed key farmers to construct infrastructure with nearby farmers from the beginning of the project. Such farmers later formed groups, of about ten farmers each, and became intermediate farmers certified by the project.

In principle, each key farmer is responsible for two intermediate farmer groups. Therefore, each key farmer oversees 20 intermediate farmers. Selection criteria for intermediate farmers were:

i Reside close to the key farmer

[12] Extension officers in charge of the questionnaire visited the farmers, directly asked the questions to key farmers, and recorded the answers. Therefore, it should be noted that the answers may be biased.

ii Actively participate in project activities
iii Use techniques recommended by the project
iv Have basic resources that are required for technology transfer through the project
v Desire support from CENTA
vi Responsibly engage in capacity development activities with the project
vii Will continue to work in agriculture in the future
viii Ownership of farm is preferred

2) Technology transfer to intermediate farmers

The effectiveness of new technology was shown to intermediate farmers through various methods including training at CENTA, study tours organized by CENTA and key farmers' demonstration farms. Of these, the success of vegetable cultivation by key farmers was the most effective method for convincing the intermediate farmers of the effectiveness of the new technology. After demonstrating the effectiveness of the new technology, JICA worked on technology transfer to intermediate farmers through group activities. Technology transfer is being promoted by creating joint farms and through joint work. Key farmers and extension officers are working together to transfer technology to intermediate farmers.

Intermediate farmers do not, however, immediately start vegetable cultivation even after receiving training on a demonstration farm. In general, there are two reasons for their reluctance:

i Because they lack the technical experience, they are worried that they may not be able to recoup their investment.
ii They have no money for the initial capital investment.

Farmers do not invest in uncertain ventures in which they have no experience. Therefore, the project provided 500 seedlings to each intermediate farmer. Although the number could have been reduced to 30 or 50 seedlings per farm, that would generate little income even if the cultivation succeeded. Therefore, farmers would not seriously work on the cultivation. The 500 seedlings present an opportunity to make a considerable income, so the farmers become serious about the cultivation. Therefore, it is important that such a grant must be of a reasonable scale.

To prepare the seedlings, intermediate farmers use the greenhouses at key farmers. If an intermediate farmer is remote from a key farm or the key farm does not jointly use the greenhouse, the project sometimes provides the materials for a greenhouse to intermediate farmers on a cost shared basis. The project also provides input of nearly $500 (e.g., 2,000 each of tomato and green pepper seeds, 100 kg of chemical fertilizer (e.g., 15-15-15), 1 liter of agricultural chemical (Previcul)) per group during the follow-up period. Infrastructure and input support for intermediate farmers are less than those for key farmers, and are provided in such a way as to take into account dissemination to other farmers in the future.

How key farmers are involved in technology transfer to intermediate farmers appears to vary from one farmer to another. Most recognize their roles as key farmers and aggressively transfer technology, but some are not adequately transferring technology to intermediate farmers due to poor health or due to deterioration in surrounding environment that has caused them to cut back on vegetable cultivation. To facilitate the farmer to farmer extension, extension officers serve an important role not only in providing technical guidance, but also in scheduling group activities and convening farmers.

In response to a question on what kind of support they provide to intermediate farmers, 18 out of 20 key farmers replied, "visit intermediate farms and give advice." "Create a demonstration farm on my own farm" was the reply given by 16 key farmers. Another popular answer was, "Invite intermediate farmers to my farm, and provide technical guidance." In response to a question on how technology is

disseminated to intermediate farmers, 15 replied, "with the support of extension officers." Fourteen replied, "key farmers play an important role" and "technology is easy." On the other hand, in response to a question on constraints to dissemination, 16 replied, "financial constraint concerning initial capital investment." Other answers provided by the key farmers were "the same support given to key farmers must be given to intermediate farmers" and "agricultural materials and input are too expensive."

On the topic of support for intermediate farmers, 15 out of 18 extension officers replied, "technical guidance on vegetable cultivation." Ten replied, "development of demonstration farms" while seven replied, "provision of market information." As for the reasons for dissemination of technology to intermediate farmers, at least ten extension officers replied each "support of extension officers," "key farmers play an important role," "technology is easy," and "technology meets the local needs and conditions." Another answer given was "provision of materials and input by the project." On the other hand, in response to the question on constraints to technical dissemination, 15 out of 18 replied, "constraints concerning initial capital investment," which was chosen by many more respondents than the second reply, "requires much manual work" (5 respondents).

(3) Transfer to other farmers

While transfer to other farmers inside the model sites and areas outside of the model sites are related to the overall goal of the project, they are not direct targets of the project. However, the project's activities do take such dissemination into account. For example, other farmers are encouraged to participate in group activities of intermediate farmers and use greenhouses. In addition, training is provided for extension officers outside of model sites. In fact, at San Martin extension office, two extension officers received training under this project, and have extended the technology they learned to farms in their area. Furthermore, a study tour was held for farms in the area to visit key farms in Zapotitán.

3.4 Sustainability of the project

3.4.1 CENTA

(1) Institutional aspect

The implementation of the project has greatly enhanced the awareness of CENTA researchers and extension officers. El Salvadoreans are in general diligent, and many counterparts are willing to work overtime. The supplies and input sent from Japan or purchased locally are being properly managed.

The ultimate purpose of this project is to disseminate technology to other areas by improving the capacity of CENTA. The counterparts of the project are anticipated to transfer the technology they have learned from the project to other extension officers and researchers. To this end, CENTA should be praised for having already created a post project plan to disseminate the new technology to eight extension offices in two phases. In fact, all but one researchers and extension officers who replied to the questionnaire replied that they have made an effort to transfer technology they have learned from the project to other researchers and extension officers.[13] In addition, pursuant to the expansion of the target area, 15 researchers who belong to CENTA's vegetable program are scheduled to join the project.

When the project ended, the organization for the project was incorporated into CENTA's vegetable program, and researchers who had worked on the project were also assigned to the program. During the

[13] Seven out of eight researchers and seventeen out of eighteen extension officers, however, replied that CENTA's insufficient budget will be a constraint to technology transfer to other areas.

follow-up period, the project provided capital for activities concerning the project. After the project ends, budgets for activities concerning vegetable cultivation must be requested through CENTA's normal process, so some researchers are concerned that there will be a longer wait until a budget is approved.

(2) Technical aspect

Japanese experts feel that, although there is still room for improvement for researchers and extension officers alike, in general, they have fully acquired the cultivation technology. For example, the chief counterpart of the training development has become completely self-sufficient. In 2004, he was appointed chief of training section (a new department), and manages all aspects of training at CENTA.

In fields that require ongoing guidance, extension officers must create and prepare farm management improvement plans. The five-year farm management improvement plan was implemented in the third year of the project. Because there was insufficient time for guidance, the counterparts are not thoroughly familiar with the plan. In addition, experts feel that researchers do not yet have sufficient ability to organize reports and create long-term research plans.

(3) Financial aspect

Financial problems are the most serious problem for the sustainability of the project. It is estimated that 90% of CENTA's budget is labor cost. After the project ends, CENTA's activities are likely to face constraints. Even while the project was under way, CENTA's budget was very limited, and was dependent upon JICA for activity expenses. JICA paid for the maintenance cost and gasoline for the minivan used for transportation for training For example, gasoline allowance for a motorcycle for an extension officer in Cojutepeque is $15 per month As the allowance was not paid, other than in January and May 2004 (according to the interview conducted in May 2004), JICA paid for the allowance on behalf of CENTA from February to April. In addition, to maintain the frequent visits to farms as done during the project, a gasoline allowance of $20 to $25 per month is necessary. Without the active participation of extension officers, dissemination of technology is expected to experience a major setback. The lack of budget is also likely to affect research activities. As the El Salvadorian government has failed to allocate adequate budget for CENTA, donors are also reducing the size of their cooperation to CENTA[14]. CENTA's finances will depend on how much the new administration, which took office on June 1, 2004, emphasizes agricultural research and extension.

Researchers and extension officers alike are concerned about sustainability. Six out of eight researchers replied, "we cannot continue similar research activities after the project ends." When asked for a reason, six out of eight replied, "CENTA's financial constraint." This was far more significant than the second answer, "Japanese experts' expertise will no longer be available" (1 respondent). In addition, fourteen out of eighteen extension officers replied, "we cannot continue similar extension activities after the project ends." When asked for a reason, twelve replied, "CENTA's financial constraint" and eight replied, "Japanese experts' expertise will no longer be available."

3.4.2 Sustainability of key farmers

The project has raised the awareness of key farmers and intermediate farmers in the model sites concerning vegetable cultivation. It has also improved their techniques. In response to a question by the study mission, majority of the key farmers replied that they can continue to cultivate vegetables without the

[14] As of May 2004, Japan was the only donor who provided principal cooperation to CENTA

support of extension officers. Experts also feel that many of the key farmers have already sufficiently learned vegetable cultivation technology. Some of the key farmers seem overconfident, however, as they still lack knowledge of pest control, in particular. Therefore, the experts point out that continued collaboration with extension officers is important.

While maintenance and management of infrastructure are essential to continuing vegetable cultivation, some key farmers do not feel that way. All key farmers whom the study team asked replied that they had stopped keeping farm record when the supply of a bookkeeping sheet from the project ceased. Without such records, it is difficult to improve the farm management and maintain infrastructure.

While key farmers are expected to serve as the core of technical dissemination to intermediate farmers and other farmers, it is uncertain whether they will continue such activities when the visits by extension officers become less frequent.

3.4.3 Dissemination to intermediate farmers and other farmers

In a survey of 100 intermediate farmers, implementation status of vegetables in Zapotitán was 82% for tomatoes, 20% for green peppers, and 24% for cucumbers. In Cojutepeque, it was 100% for tomatoes, 48% for green peppers, and 42% for cucumbers[15]. The cultivation of all these vegetables essentially began under the guidance of the project. The project provides part of the input, such as seeds, to intermediate farmers. Experts estimate that the area cultivated at the farmers' own expense is expected to be about half of that shown above.

There are cases in which greenhouses are constructed outside of project target areas. By May 2004, seven greenhouses had been constructed in the San Martin extension office area neighboring the Cojutepeque extension office. All these greenhouses were built with external financial support. They were constructed after extension officers received training by the project, and farmers visited key farmers. In some cases, farmers constructed greenhouses with their own funds. For example, in Tonacatepeque, Cuscatlan, a woman who was born in the village and now lives in the United States made continuing donations to the village through the Catholic Church. From the donation, $670 was allocated for greenhouses. Ten farmers then jointly paid $230 ($23 each) to build the greenhouse[16].

While dissemination of technology can be observed, considering that all the greenhouses constructed in the area under the jurisdiction of the San Martin extension office were built with external financial support, before the technology can be extended to ordinary, small farmers, the target of this project, it is necessary to reduce the cost of infrastructure and provide farmers with financial assistance (e.g. provide loans with a low interest). CENTA is already working on the former. Today, the cost of a set of three facilities (greenhouse, water tank, and drip irrigation system) has been reduced to around $1,000. In San Martin extension office area, there is an example of a small greenhouse with 1 m x 1 m floor being constructed for $60 (with the financial support of PROMIPAC). As for the latter, while lending between farmers exists, the country still lacks credit for small-scale farmers and crop insurance. Therefore, it is essential to provide support (small agricultural loan system) for the purchase of infrastructure materials and input. Experts also feel that, without continued cooperation of some form, it will be difficult to meet the overall goal of the project, "by the year 2008, 1500 small-scale farmers in the country adopt techniques for sustainable farming systems through the assistance from CENTA". Extension officers, key farmers, and

[15] Follow Up Project for the Strengthening of Agricultural Technology Development and Transfer in El Salvador, Results of the Survey of Intermediate Farmers (2002 and 2003) and Farm Management Plans (2004), July 2004 (In Japanese)

[16] Of the remaining six, four were built with support from the Belgian Government, one was built with money sent by a friend in the United States, and one with the support of PROMIPAC, which is supported by the Swiss government.

intermediate farmers also point out that without continued support, technology transfer will be difficult. How long the extension officers' activities (depending on CENTA's financial conditions) and joint work with key farmers will be continued are an important key to extension.

In terms of sales, it appears that the key farmers have cost competitiveness on the market. The vegetables that they grow are being sold. Although tomato production increased from 2003 to 2004 and tomato prices plummeted, prices regained some ground during the rainy season of 2004. Therefore, the farmers are apparently making sufficient profit even from the rainy season crop. Farmers are also switching to other vegetables in response to such price fluctuations. In a hearing of key farmers, it was found that they do not see a problem with cultivating other vegetables according to market conditions. As intermediate farmers have only recently begun the technology transfer, they do not seem to have such flexibility yet.

Photo 4-1. Traditional rain-fed paddy field (Each lot is small.)

Photo 4-2. Plowing with a hand hoe (Lekitatu)

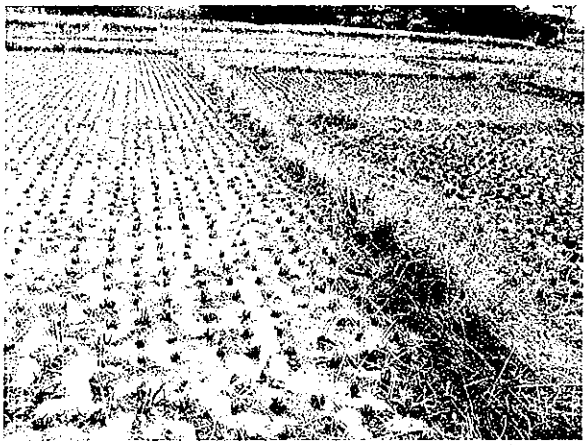


Photo 4-3. Expansion of a lot for efficient land use (Lekitatu)

Photo 4-4. Rice near harvest (Lekitatu)

Photo 4-5. Irrigation canal (Mombo)

Photo 4-6. Key farmer's plot, next to which is a plot of an intermediate farmer (Mombo)

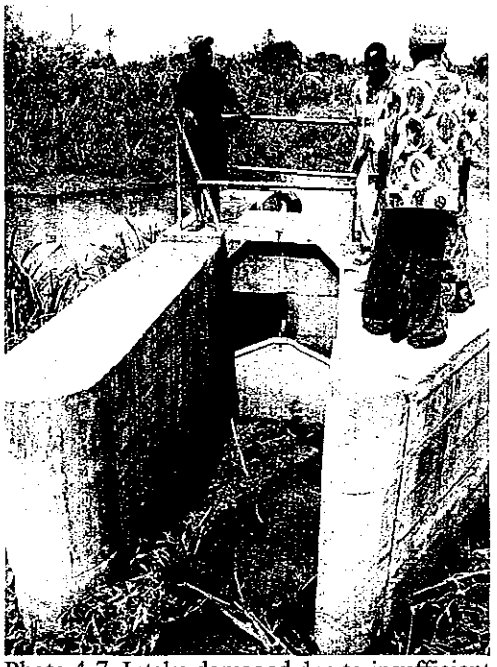


Photo 4-7. Intake damaged due to insufficient management by farmer organization (Mahenge)

Photo 4-8. Farmers working in a paddy field (Kwemazandu)

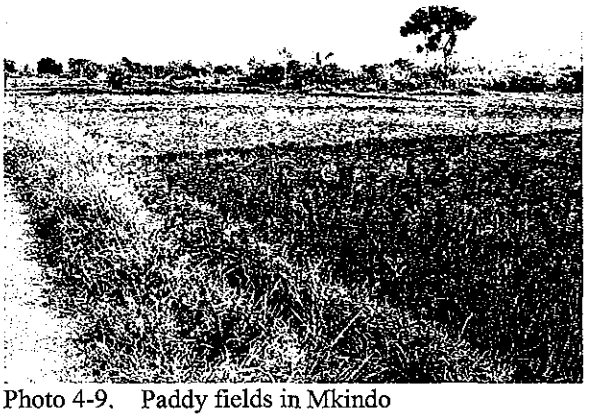


Photo 4-9. Paddy fields in Mkindo

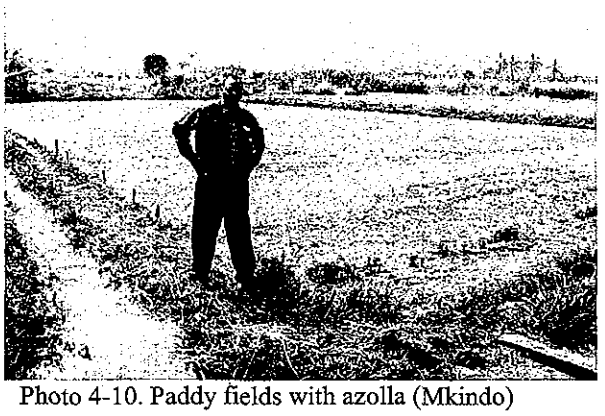


Photo 4-10. Paddy fields with azolla (Mkindo)

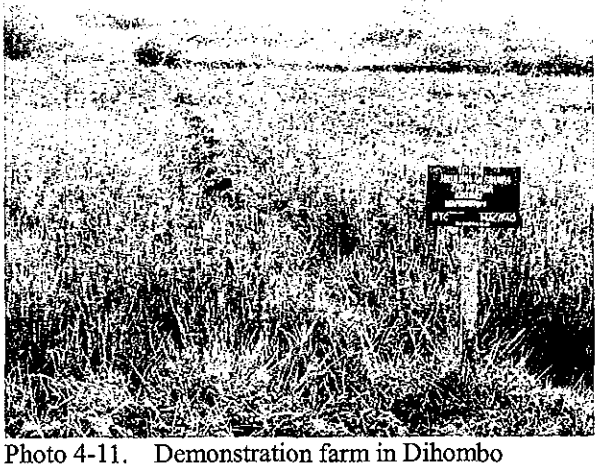


Photo 4-11. Demonstration farm in Dihombo

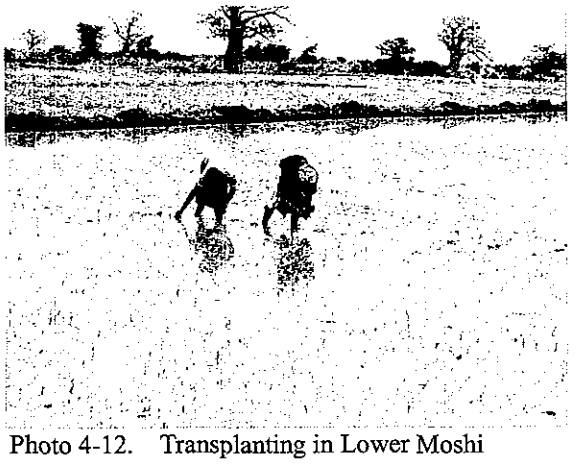


Photo 4-12. Transplanting in Lower Moshi

4.1 Outline of the project

4.1.1 Tanzania Kilimanjaro Agricultural Training Center Phase 1 Project

Japan has provided cooperation in irrigated rice cultivation to Tanzania through the Kilimanjaro Agricultural Development Center (KADC) Project and the Kilimanjaro Agricultural Development Project (KADP) in Kilimanjaro Region since the 1970's. In the 1980's, the Lower Moshi irrigation scheme was constructed with a yen loan, and an irrigated rice cultivation technology suited to the area was developed. As a result, the scheme increased the yield from 2 tons/ha to 6 tons/ha, or some three times the national average.

Upon the completion of KADC and KADP, a new project began with the objective of disseminating the irrigated rice cultivation technology developed in Kilimanjaro to the rest of the country. Kilimanjaro Agricultural Training Center (KATC) was established under the jurisdiction of the Training Division of the Ministry of Agriculture and Food Security (MAFS) (at the time, the Ministry of Agriculture and Cooperatives). KATC's phase 1 project was launched in July 1994. It ended in June 2001, including a two-year follow-up period. Table 4-1 shows a project design matrix (PDM) of the phase 1 project.

The overall goal of the project was to train extension officers and farmers around the country with the irrigated rice cultivation technology obtained in Kilimanjaro. To this end, KATC launched training courses, developed training curriculum, and trained tutors. The training courses were rice cultivation course for extension officers and district crop officers, water management course for irrigation technicians, rice mechanization course for agricultural mechanization officers, tractor operator course for tractor operators, and key farmer course for farmers and extension officers. While the principal objective of the project is to reinforce the capacity of KATC as a training institute, activities associated with extension were also included in the project. More specifically, besides providing extension officers with training, the project also provided training to key farmers who will serve as the key to dissemination in the irrigation scheme. Joint training for extension officers and key farmers was designed so they can cooperate in technology transfer after the training. During the two-year follow-up period, KATC visited the irrigation schemes where extension officers and farmers came from, and provided follow-up guidance and outreach training.

4.1.2 Tanzania Kilimanjaro Agricultural Training Center Phase 2 Project

Phase 2 has been conducted after phase 1 ended. Phase 2 is scheduled to run from October 2001 to September 2006. Although phase 1 achieved the objective of developing a training institute to provide irrigated rice cultivation training, such training activities alone did not necessarily transfer technology to farmers. Therefore, in phase 2, the principal training site was transferred from KATC to irrigation schemes in the country. The objective is to develop a training package that is actually adopted by farmers.

The overall goal of the project is "productivity of rice increases in the place where KATC training has been conducted and surrounding area." The purpose of the project is "productivity of rice increases in the model sites through the KATC's training." To attain the purpose, KATC works close to the field. For KATC to be able to develop and manage training packages that are suitable for the various natural and socioeconomic conditions of Tanzania, six model sites (Mombo, Mwega, Mbuyuni, Nakahuga, Mwamapuli, and Nduguti) were selected by zone from irrigation schemes around the country. Four field training (the last one is monitoring) are held per cropping season at each model site (Map 4-1).

Table 4-1. Tanzania Kilimanjaro Agricultural Training Center Phase I Project Project Design Matrix

Narrative Summery	Verifiable Indicators	Means of Verification	Important Assumtions
Super Goal Rice Farmer economy is improved in Tanzania.	Change of farmers' living standard.	Farm economic survey or statistic data,	- Health conditions of rice growing farmers are maintained. - Adopting the improved rice cultivation techniques by rice cultivating farmers.
Overall Goal With respect to irrigated rice cultivation, technical capabillty of trainers, agricultural extension personnel, water management personnel, agricultural machinery personnel, and key-farmers is enhanced in Tanzania.	Technical capabilities of trainers for extension personnel, extension, water management- and agricultural machinery personnel and key-farmers at certain time since completion of the Project.	Result of post-project evaluation conducted through dispatch of study team or by JICA Tanzania Office with Tanzanian side.	- No policy change for setting priority on the extension of irrigated rice cultivation including producer price and marketing systems. - Allocation of sufficient funds for extension activity. - Assigning ex-trainees too adequate posts for the extension of irrigated rice cultivation.
Project Purpose With respect to irrigated rice cultivation, the institutional capalility of KATC to train extension personnel and other concerned people is strengthened.	- Maintained or expanding capacity of the number of trainees. - Satisfaction of the graduates for the training. - Self-evaluation of the capability by KATC staff.	Records of the training. Attitude survey for graduates and post graduates of the training. Questionnaire and interview for the staff.	Authorizing recommendations on the improved extension method of irrigated rice cultivation formulated by KATC.
Output With respect to irrigated rice cultivation; 1 Technical capability of trainers is enhanced; 2 Training method is improved; 3 Training material is improved; 4 Extension- water management- and agricultural machinery personnel, and key-farmers are trained; 5 Improved extention method is recommended.	1 Technical capability of trainers. 2 Contents of training method. 3 Achievement of training courses (number of trainees, comparison of trainee's technical level between before and after training). 5 Contents of recommended extension method.	1 Questionnaire survey for trainers. 2 Periodic reports, printed materials. 3 Training manuals, printed materials. 4 Periodic reports, questionnaire survey for trainees. 5 Periodic reports. 1-5 Project evaluation survey.	- Continuous research activities for rice cultivation suitable for natural and social conditions in reaearch organizations. - Continuous collaboration between KATC and organizations concerned. - Continuous financial support for irrigated rice cultivation training and other related activities.
Project Activities With respect to irrigated rice cultivation, following activitics are implemented in the fields of agricultural extension and training, rice cultivation, water management, and agricultural machinery. 1 Enhancement of technical capability of trainers:On the job training through the activities of (2) to (5) below, counterpart training in Japan; 2 Improvement of training methods; Trainng plan, training curriculum; 3 Improvement of training materials; Information collection, verification trial, field survey, preparation of training manual; 4 Training for government personnel and key-farmers:Training seminar, follow up guidence for ex-trainees, out-research programme: 5 Improvement of extension methods.	V. Input Japanese Side 1 Expert 1)Team Leader 2)Coodinator 3)Agricultural Extension and Training 4)Rice Cultivation 5)Water Management 6)Agricultural Machinery 7)Short-term expert 2 Equipment and Machinery Equipment necessary for training, etc. 3 Acceptance of Tanzanian Personnel for Training in Japan. Some persons each year 4 Others: Local cost support	Tanzanian Side 1. Personnel 1)Project Director 2)Assistant Project Director 3)Project Manager 4)At least 3 Full-time C/Ps for Each Technical Expert in KATC and 1Desk Officer in the Headquarters of Training Institutes Unit. 5)Administarative and Supporting Staff 2. Land, Buildings and Facilities 1)Main Office of the Project 2)Sub-office of the Project 3)Office Space in Training Institutes Unit 4)Others; Construction of a New Hostel and Grain Storage Facility 3. Running Expenses 1)Running Expenses for the implementation of the Project 2)Financial support from related projects for running training courses	1 Adequate finiancial support for the activities. 2 No trasferring of counterpart personnel. 3 No security problem happens. 4 Trainees are recruited in rice cultivation areas. Pre-conditions 1 Joint Advisory Commitee is established. 2 Organization, personnel, and function of KATC are clearly defined. 3 Necessary number of C/Ps with qualification in KATC and a Desk Officer in the headquarters of Research & Training are assigned. 4 Necessary budget for KATC is secured. 5 Extension service network functions. 6 There exists sufficient number of extension personnel, including personnel in the fields of water management and agricultural machinery to be trained at KATC. 7 Cooperation from the organizations concerned to the Project is secured.

Source: JICA, 1999, Kilimanjaro Agricultural Training Center Project in Tanzania Project Evaluation Report at Completion

The dissemination approach at each model site is farmer-to-farmer extension. Twenty key farmers were selected at each model site, and KATC has transferred technology to these key farmers through residential training at KATC and field training. Next, each key farmer has selected five neighboring intermediate farmers, and with the support of extension officers, transfer technology to intermediate farmers through field training. Each intermediate farmer is also scheduled to select two (one male and one female) other farmers and transfer technology. While outside the scope of the project, the dissemination of irrigated rice cultivation technology beyond irrigation scheme is also being considered. KATC is discussing with the district government and zone irrigation offices to seek for their participation.

Map 4-1. Tanzania and Phase 2 Project Model Site

4.2 Project formulation

4.2.1 Background

(1) Profile of Tanzania

Tanzania is located in eastern Africa. The country has a population of approximately 35 million and land area of 945,000 km^2. Tanzania faces Indian Ocean to the east, Kenya and Uganda to the north, Rwanda, Burundi, and Zaire to the west, Zambia, Malawi, and Mozambique to the south. Table 4-3 shows Tanzania's key economic indicators. GNI per capita is $290 (2002) and average life expectancy is 43.1. The country's economy has grown at more than 6% in recent years. Agriculture is Tanzania's primary industry, and accounts for more than 40% of the country's GNI.

Table 4-2. Kilimanjaro Agricultural Training Center Phase II Project in Tanzania Project Design Matrix

In Tanzania

Target Group: Rice farmers in the irrigation schemes
Project Area: selected irrigation schemes (Date: 25 May, 2004)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Super Goal Living standards of rice farmers in the irrigation schemes are improved.			There are no major policy changes.
Overall Goal Productivity of rice increases in the place where KATC training has been conducted and surrounding area.	1 Average rice yield of sample farmers in the training conducted sites and surrounding area increases by 25% by 2010 compared to the national average of 2002 (2.5t/ha). 2 By 2010, the net return rate from rice to family farm in the training conducted sites and surrounding area increases compared to those of 2002.	1 Baseline survey 2 Ex-participants report 3 Monitoring report	Income is used for better living standards.
Project purpose Productivity of rice increases in the model sites through the KATC's training.	1 Average rice yield per unit area of sample farmers in model sites increases by 9-24% by 2005 compared to 2002. 2 By 2005, the net return rate from rice in all the model sites increases compared to those of 2002 3 By 2005, properly irrigated area increases in all the model sites compared to those of 2002.	1 Base line survey 2 Ex-participants report 3 Local consultant survey report 4 Farming survey 5 Yield survey	No agricultural policy changes
Outputs 1 The concept of and approach to the model site are established (based on the agreement of all the stakeholders).	1 By the end of August, 2002, six (6) model sites are selected on the basis of the criteria.	1 Minutes of JCC 2 Criteria	
2 The capability of KATC in identifying training needs is improved.	2-1 At the beginning of every training course, more than 90% of course participants agree with the course contents as relevant to their needs. 2-2 In more than 80% of training courses, more than 80 % of training participants rank A (Excellent) or B (Very good) in questionnaire.	1 Training report 2 Questionnaire 3 Evaluation for each training	
3 Technical training programs are strengthened to meet local needs.	3-1 By 2005, 80 % of key farmers adopt at least 80% of basic field techniques learnt and 80% of Intermediate Farmers adopt at least one basic field technique learnt. 3-2 By 2005, technical standards on rice cultivation are established in all model sites through field trial activities conducted by field personnel and key farmers. 3-3 By 2005, the field versions of technical manuals for each model site is prepared based on local needs. 3-4 Modified field training programe(s), which encourage districts to adopt KATC trainings as an implementation tool of their DADP, are developed.	1 Training report 2 Monitoring report 3 Technical standards summarised by Rice Cultivation section 4 Local consultant survey report 5 Farming survey 6 Training report	The ex-participants remain in the irrigation scheme. District levels recognize the importance of improved rice farming and implement extension.
4 Training program for improving institutional framework of irrigation scheme is strengthened.	4-1 Implementation plan (IP) for each model site is prepared, implemented, and revised based on the implementation result jointly by district, scheme, zonal irrigation office and KATC, with the special emphasis on cost sharing. 4-2 By 2005, farm operation calendars and plans are prepared, carried out and evaluated by managing personnel, key farmers and intermediate farmers in each model site. 4-3 By 2005, active membership of irrigators' association / cooperative societies in each model site increase compared to 2002. 4-4 The manual / guide for strengthening institutional framework is prepared by the end of the project.	1 Training report 2 Farm operation calendar 3 Evaluation report 4 Interview 5 Seminar and workshop proceedings 6 Local consultant survey report 7 Field survey	
5 The capability of KATC in collecting and providing useful irrigated rice cultivation information is improved.	5-1 By 2006, library database and classified information database are established. 5-2 By 2006, four Kiswahili & two English newsletters in a year and annual technical progress reports are prepared, and web-site of KATC is established and revised on monthly basis.	1 Database 2 Newsletters, Progress report	
6 The concept and approach to mainstream gender into plan, implement and monitor technical training on irrigated rice production are established.	6-1 Project activities are implemented according to the gender checklist based on Plan of Operation. 6-2 Through the project period, the percentage of women participants in Key Farmers course and in-field training is more than 45% by considering gender needs in model sites. 6-3 By 2006, at least one specialized subject training based on Gender needs is conducted for and the activity is adopted in each model site.	1 Baseline survey report 2 Training report 3 Monitoring report 4 Local consultant survey report 5 Gender checklist	

Activities	Inputs		
1-1 Study the situation of selected 40 irrigation schemes in order to determine their potential for development. 1-2 Conduct the group training courses on irrigated rice production techniques for scheme managers, field personnel and kev farmers of the selected 40 irrigation schemes. 1-3 Select model sites based on the criteria to be agreed. 2-1 Conduct surveys to identify the situation and problems and to collect baseline data for monitoring. 2-2 Conduct analysis of the information collected. 3-1 Prepare the activity plan to improve irrigated rice production techniques in each model site. 3-2 Conduct the training courses on irrigated rice production techniques for field personnel and key farmers (with special consideration for female farmers) of the model site at KATC. 3-3 Conduct the field training with irrigated rice production skills for field personnel and key farmers (with special consideration for female farmers) in each model site. 3-4 Provide technical assistance to the ex-participants on irrigated rice production at the model site. 3-5 Monitor the activities of ex-participants in each model site. 3-6 Verify and confirm the applicability of KATC training programme. 4-1 Prepare, implement, and revise Implementation Plan (IP) for each model site with district, scheme, zonal irrigation office. 4-2 Improve the management of irrigators' associations / cooperative societies in model sites. 5-1 Establish information management system. 5-2 Collect and classify the information. 5-3 Supply the information to the concerned organizations and individuals. *[Gender related activities are reflected on above activities. They are not treated as the independent field.]* 6-1 Identify gender training needs of selected model sites and integrate them into Implementation Plan. 6-2 Plan, conduct and monitor the technical training of irrigated rice production with gender consideration. 6-3 Organize gender related information on irrigated rice production.	**Japanese side** 1. Dispatch of Japanese Experts (1) Long-Term experts (maximum 5 persons) Chief Advisor Coordinator Other Long-Term experts ・Extension and farmers training ・Rice cultivation ・Irrigation management ・Farming Management (2) Short-Term Experts 2. Provision of Machinery and Equipment 3. Training of Tanzanian Counterpart Personnel in Japan 4. Dispatch of a Survey Team	**Tanzanian side** 1. Assignment of Tanzanian Personnel (1) Project Director (2) Project Manager (3) Counterpart personnel in the field of ・Extension and farmers training ・Rice cultivation ・Irrigation management ・Farming Management (4) Counterpart personnel for short-term Experts (5) Administrative personnel (6) Other necessary personnel mutually agreed upon as necessary 2. Local Running Expenses 3. Provision of lands, buildings and other necessary facilities	Weather conditions remain favourable to irrigated rice farming. **Pre-conditions** Rice farmers in the selected irrigation schemes agree with the objectives of the project. Security situation of the country remains stable, and safety of property at KATC is assured.

Table 4-3. Tanzania's Economic Indicators

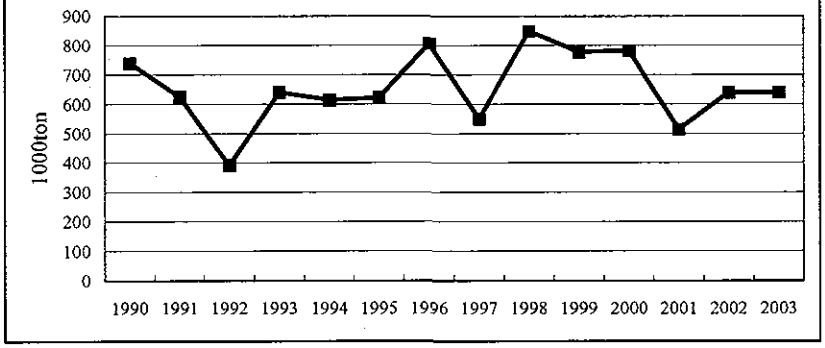
Series Name	1998	1999	2000	2001	2002
Agriculture, value added (% of GNI)	44.8	45.1	45.0	44.8	44.4
Industry, value added (% of GNI)	15.4	15.5	15.7	16.0	16.3
Services, etc., value added (% of GNI)	39.8	39.4	39.2	39.2	39.3
GNI Growth Rate	3.7	3.6	5.7	6.1	6.3

Source : World Bank, World Development Indicators, Various years.
Note: Sector-wise employment is unknown.

(2) Rice in Tanzania

Rice, as are corn, sorghum, wheat, and pulse, is a principal crop in Tanzania. Fig. 4-1 shows the changes in production of rice since 1990. While rice is profitable even when grown in rain-fed rice paddies, it is extremely profitable when grown in irrigated schemes (Table 4-4). In addition, as rice can be stored longer than many other crops, farmers can sell their harvest according to the market price. These advantages make rice a popular crop among farmers.

Figure 4-1. Rice Production in Tanzania



Source: FAOSTAT, 2004, http://faostat.fao.org/faostat/collections?subset=agriculture

Table 4-4. Profitability of Principal Crops in Tanzania

(Unit : Tanzania Schilling/ha)

Crop \ Region	Mtwara	Singida	Mwanza	Moshi	Mbeya
Corn	21,000	26,250	30,400	27,000	28,000
Sorgum		28,000	30,000		
Rice			85,000 (Rainfed)	238,500 (Irrigated)	90,250 (Rainfed)

Source : The United Republic of Tanzania, 2000, Agriculture: Performance and Strategies for Sustainable Growth.
Note: Costs for construction, operation and maintenance of irrigation facilities are not included.

4.2.2 Project formulation

Tanzania assigned primary donors by region in the 1970's. Japan was assigned to Kilimanjaro Region. Since then, Japan has assisted the economic development of the region. In order to establish irrigated rice cultivation technology and to transfer the technology, Japan has provided a combination of various forms of cooperation including project type technical cooperation, development study, grant, yen loan, and grant aid for increased food production (2KR). For example, Japan has provided cooperation with irrigated rice cultivation through Kilimanjaro Agricultural Development Center Project (KADC) and Kilimanjaro Agricultural Development Project (KADP) since the 1970's. In the 1980's, the Lower Moshi irrigation scheme was constructed by using a yen loan, and an irrigated rice cultivation technology suited to the area was developed. As a result, yield per hectare in Lower Moshi increased to 6 to 7 tons (average yield in Tanzania is approximately 2 tons per hectare), and the rice cultivation technology (varieties and cultivation method) was disseminated not only to surrounding areas, but also to neighboring regions.

Kilimanjaro Region, which is the counterpart for KADC and KADP, and the Japanese side (related organizations such as the Embassy and local JICA office) discussed what should be done after KADP ended in 1993. In this discussion, it was decided to extend the output from the Lower Moshi irrigation scheme obtained through KADC and KADP to rice cultivation areas throughout Tanzania. It appears that the decision to spread the target area from the region to the entire country was made partly because Japan questioned whether it should limit its cooperation to Kilimanjaro. When the project was revised to encompass the entire nation, the question arose on whether Kilimanjaro Region would be the appropriate organization responsible for the project. As a result of discussions with the Tanzanian government, the Ministry of Agriculture and Food Security (MAFS; at the time, Ministry of Agriculture and Cooperatives) was designated as the responsible organization. Although the Kilimanjaro Region was reluctant to be replaced by the Ministry as the responsible organization, Japan insisted on changing the responsible organization. This is believed to be an important step in expediting KATC's activities.[1] The decision was also made for KATC to succeed the facilities and equipment of KADP located in the Lower Moshi irrigation scheme.

In accordance with the change of responsible organization, the Tanzanian government abolished one of the training institutes (Ministry of Agriculture Training Institute (MATI) Tumbi), established Kilimanjaro Agricultural Training Center (KATC) under the Training Division in 1994, and designated the KATC as the implementation agency of the project.

4.2.3 Purpose of the project

The overall goal of the phase 1 project is "with respect to irrigated rice cultivation, technical capability of trainers, agricultural extension personnel, water management personnel, agricultural machinery personnel, and key-farmers is enhanced in Tanzania." The project goal is "with respect to irrigated rice cultivation, the institutional capability of KATC to train extension personnel and other concerned people is strengthened." As these goals indicate, the scenario is to improve KATC's capacity and, consequently, to improve the technology of Tanzania's irrigated rice cultivation personnel who receive training at KATC.

4.3 Phase 1 project implementation

4.3.1 Start-up of the project

Upon commencement of the phase 1 project, KATC had to be started from the ground up. Neither the Tanzanian side nor the Japanese side had sufficient time to prepare by the time the project began. Besides having appointed one KADP staff member, the Tanzanian side had not assigned any other individual to KATC. In terms of facility, since KADP had been inherited, it did not have sufficient features as a training institute. Likewise, not all the Japanese experts had been named for the project, so it had to have short-term expert in charge of extension.

No training was provided in the first year, and only preparations were taken for offering training. Five training courses were set, but there was no curriculum or text, so the work began by preparing them. When the training curriculum was completed, agricultural and livestock development officer was invited from each region across the country to introduce KATC and present the irrigated rice cultivation situation in each region. The agricultural and livestock development officers were then asked to have extension

[1] In November 2002, the decision was made to merge the Training Division of the Ministry of Agriculture and Food Security with Research and Development Division. But no changes have been made yet (as of September 2004).

officers participate in KATC training. This was the necessary first step to spread the name and training of KATC across Tanzania.

Concise History of Japan's Cooperation with Agriculture in Kilimanjaro

1970	Request is submitted from Tanzania to conduct a development study of the Kilimanjaro Region
1974	Kilimanjaro development study mission is dispatched
1978, February	Kilimanjaro development plan is submitted
1978, May	Request is submitted from Tanzania for cooperation with 14 projects in the plan
1978, August	Agreement is reached on the 6 projects below. ① Agricultural development (technical cooperation) ② Small and medium enterprise development (technical cooperation) ③ Lower Moshi agricultural development (development study and yen loan) ④ Tractor hiring service (technical cooperation) ⑤ Installation of power transmission network (development study and yen loan) ⑥ Mukomazi Valley agricultural development study (development study)
1978, September	Signed R/D for Kilimanjaro Agricultural Development Center (KADC) Project ① Technical advice on water resource development for irrigation development ② Activities on trial farms and pilot farms ③ Extension activities (transferring the output of trial farms and pilot farms to farmers) ④ Training (short-term training for Tanzania's counterpart, extension officers, and farmers)
1979, November	Signed E/N for grant aid for the construction of KADC (and KIDC)
1982	Yen loan contract concluded for Lower Moshi agricultural development project
1982, August	Signed R/D for extension of KADC (3 1/2 years)
1984, May	Lower Moshi agricultural development project is commenced
1986, February	Signed R/D for Kilimanjaro Agricultural Development Project (KADP) In Kilimanjaro, particularly Lower Moshi: ① Select appropriate varieties of rice, establish cultivation technology, demonstrate and provide extension training ② Establish farm cultivation technology and demonstrate and provide extension training ③ Establish water management technology, provide extension training, advice on maintenance and management of water facilities ④ Guidance and training on field tests and maintenance of agricultural machinery
1986, March	KADC is completed
1986, April	KADP is commenced
1990, November	Evaluation team at project completion recommends two-year follow-up upon completion of KADP
1993, March	KADP follow-up cooperation is completed
1994, January	Signed R/D for Kilimanjaro Agricultural Training Center (KATC)
1994, July	KATC's cooperation begins
1999, February	Evaluation team at project completion recommends two-year follow-up of cooperation upon completion of KATC Tanzania requests for KATC phase 2
2001, June	KATC phase 1 is completed
2001, July	Signed R/D for KATC phase 2
2001, October	KATC phase 2 cooperation begins (until September 2006)
2004, May	Signed mid-term evaluation report on KATC phase 2

4.3.2 Selecting the target group

When phase 1 was launched, JICA had a reasonable knowledge of rice cultivation in Kilimanjaro through cooperation with past projects. But it had little knowledge of rice cultivation in other regions of Tanzania, and it was not possible to narrow down the (geographical) areas where training should focus. In addition, as Tanzania places a priority on treating all its regions equally, the project was primarily targeted at extension officers and farmers across the entire country.

Rice cultivation in Tanzania is generally classified into three types. First is irrigated rice cultivation with well-equipped facilities as seen in Lower Moshi, but this is an exception rather than the rule. Second is irrigated rice cultivation where facilities are available, but water cannot be adequately controlled. Third is rain-fed paddy field. KATC is primarily catered to the extension officers and farmers in the second type of irrigated rice cultivation area.

4.3.3 Irrigated rice cultivation technology

Before KATC was launched, there was already precedence of technical development through KADC and KADP. For example, high yielding rice variety (e.g., IR54) had been selected for the Lower Moshi irrigation scheme, and its cultivation method and effective use of water had already been established. By using such techniques, KADP had realized a yield of 6 tons/ha, or three times the average yield in Tanzania (reported to be 2 tons/ha), in the Lower Moshi irrigation scheme. The success relied on relatively easy water management, abundance of fertilizer and insecticides, and availability of tractors. Therefore, KATC predicted that teaching farmers in other areas the same technology would not produce the same results. For example, although rice paddies in Lower Moshi are of uniform size and benefit from extensive use of machinery, rice paddies in other areas of Tanzania are of uneven size and are plowed with hand hoes. Considering the current conditions of irrigation facilities in Tanzania, Japanese experts devised with its counterpart a technology that can be realized even in areas with inadequate irrigation facilities.

The techniques taught in training at KATC (in phase 1 and phase 2) are basic rice cultivation techniques, and are not difficult for farmers. Such techniques include seed selection by using salt water, nursery preparation, transplanting (line planting), plowing and leveling, bund making, weeding, fertilizer application, pest and disease control, and water management. The basic concept is to increase yield by more appropriate and timely management. For a smallholder farmer with limited resources, the resource that he/she can most readily invest is the labor of his/her family. Therefore, making an effective use of family labor is important. Furthermore, the techniques recommended by KATC do not require more input (other than labor) than conventional techniques, unless the farmer selects a high yielding variety. The new techniques also use the same farm equipment that has been used in the area. According to a survey of key farmers who participated in KATC's training in phase 1, an average farmer has four hand hoes, one sickle, two knives, and one machete.[2] The project developed the techniques for which such simple farm equipment could be used. The training also provided related techniques such as using water buffaloes for plowing, using azolla[3] to promote nitrogen absorption, and using ducks to reduce the need to enter the paddy field and thereby preventing malaria.

4.3.4 Reinforcing the capacity of KATC

The capacity of KATC was improved through the project periods of phase 1 and phase 2. This section

[2] KATC Newsletter "Rice and People in Tanzania" Vol. 4 (June 1997) (In Japanese).
[3] Type of algae that shield light to control the sprouting and growth of weed. It also fixates atmospheric nitrogen and controls evaporation.

primarily describes the measures taken in phase 1.

(1) Institutional aspect

1) Establishment of KATC

As described above, KATC was established as a training institute under the jurisdiction of MAFS Training Division upon commencement of this project. Table 4-5 shows the training institute under the jurisdiction of MAFS Training Division. Among these training organizations, KATC is the only organization that trains farmers in irrigated rice cultivation technology. KATC also differs from other training institute in that it is a short-term training institute that provides graduates with no diploma. Other training organizations provide training for longer periods (e.g., two years) and grant diplomas to graduates. In addition, KATC is a unique institute with no similar institute in East Africa. Due to these characteristics, KATC provides cooperation to a wide range of targets including the four neighboring countries Kenya, Malawi, Uganda, and Zambia in phase 2.

Table 4-5. Training institutes under the Jurisdiction of Ministry of Agriculture and Food Security, Training Division

Training Centers	Province	Area	Dormitory Capacity	Founded
MATI Ilonga	Morogoro	175	216	1972
MATI Madaba	Ruvuma	1402	84	1990
MATI Mlingano	Tanga	400	120	1970
MATI Mtwara	Mtwara	560	148	1974
MATI Igurusi	Mbeya			1997
KATC Moshi	Kilimanjaro	25	60	1994
MATI Ukiruguru	Mwanza	275	260	1937
MATI Uyole	Mbeya	51	500	1975

Source: JICA, Preliminary Study Report on Kilimanjaro Agricultural Training Center Phase II Project in Tanzania, 2000, page 216 (In Japanese)

It was very important that KATC was internalized as an institution of the Tanzanian government from the outset of the project. The Sokoine Extension Project, which was conducted by Sokoine University of Agriculture (SUA) with the support of Ireland, failed to be internalized within MAFS during the entire project period of more than ten years, and the impact of the project was limited.[4]

2) Establishment of four sections

When the project began, KATC was not fully prepared as a training organization. Later, four sections (Agricultural Extension and Training, Rice Cultivation, Water Management, and Agricultural Machinery) were formed, and an expert and counterparts (at least two) were assigned to each section. Training courses were then configured by the sections collaborating with one another.

The experts and counterparts work next to one another behind adjoined desks. MAFS Training Division praises such large-room layout as it facilitates the sharing of information and aids in effective technology transfer.

[4] MAFS and Ireland AID、2001、Sokoine Extension Project Final Evaluation.

3) Hiring of tutors

In Tanzania, rice is a minor crop. Even SUA or MATI has little time to spend on rice, and has few people who are knowledgeable about rice cultivation technology. Therefore, KATC hired individuals who had worked as extension officers or technicians at KADP as tutors. They were hired because they had acquired some knowledge of irrigated rice cultivation technology at KADC or KADP. Such extension officers, however, had little experience teaching at a training institute. Therefore, KATC held a seminar on teaching methods with experts from the Agricultural Human Resource Development Center in Morogoro.

4) Accumulation and dispatch of knowledge and information obtained in training

Since there was little information or knowledge on rice cultivation in Tanzania at the beginning of the project, information on rice cultivation in each area was collected through the participants. For example, farmers were asked to bring rice seeds that they use on their own farms to the training.

Such knowledge and information were shared with other organizations. For example, rice seed received from training participants were provided to the Kilombero Agricultural Training and Research Institute (KATRIN) in Ifakara, Morogoro. The seed were also provided to the Tropical Pesticide Research Institute (TPRI) in Arusha to help expand the rice genetic resource bank.

With the aim of becoming the information center for rice cultivation technology in Tanzania, KATC issued "Rice and People in Tanzania" in English. Issued four times a year, this technical newsletter was distributed for free of charge to related organizations and individuals who have completed training. The newsletter was also published in Japanese. It was written primarily by Japanese experts, and its content differed from that of the English version.

5) Improvement of facilities

During the project period, facilities were expanded and improved. For example, in phase 1, 2.4 ha of the 11 ha owned by KATC were cultivated and used as hands-on practice farm for tutors.

(2) Technical aspect

The purpose of this project is to reinforce the capacity of KATC. The training program carried out by KATC itself incorporates an element of technology transfer to its tutors. In this respect, how training courses are created and the characteristics of training program can also be considered as measures to reinforce the capacity of KATC. This section, however, focuses on improving the technical capacity of KATC's tutors. Details of the training project carried out by KATC are provided in the proceeding sections.

1) *Tutor training with emphasis on practicality*

In the beginning of the project, the tutors were asked to write training text for rice cultivation. KATC found that the tutors placed too much emphasis on theory and not enough emphasis on practicality. As a result, the training text was inappropriate. Therefore, the experts worked with the tutors to develop a training curriculum and textbook. In this process, the experts felt that it would be important to have the

tutors actually experience rice cultivation on a farm. The experts used a farm at KATC as a training ground for the tutors. The tutors were sometimes reluctant to enter the farm, and hired others to do the difficult work. After continuing the work for more than two years, however, the tutors gained greater practical experience. When they were able to cultivate rice by themselves, the tutors gained self-confidence. Extension officers, in turn, became more willing to follow the guidance of tutors.

According to a questionnaire of eleven extension officers who received training at KATC, all the extension officers replied that the training at KATC helped them improve their capacity as extension officers. When asked which ability was improved the most, nine replied "irrigated rice cultivation technology," six replied "experience on the farm," six replied "understanding the needs of farmers," five replied "ability to communicate with farmers," and five replied "organizing farmers." These replies indicate that the extension officers praise the training particularly for teaching them practical rice cultivation technology on the farm and for improving their ability to communicate with farmers.

2) Changing the awareness of tutors and extension officers

In teaching the tutors, the greatest emphasis was placed on changing the awareness of tutors. The experts who was assigned to KATC as extension and training expert at the start up of phase 1 felt that it is most important for the tutors to view extension as an opportunity for them to learn from farmers, and that it is important to instill such an awareness in the tutors. Until then, tutors and extension officers primarily saw themselves as being above the farmers and that they are teaching the farmers. Farmers, however, have their own experience and knowledge, and are reluctant to accept any techniques that are irrational based on their experience and knowledge. On the other hand, farmers are always curious about what neighboring farmers are doing. If a local farmer tries a new technique and it turns out to be successful, farmers will copy the technique. In essence, extension cannot succeed unless the tutors and extension officers make an effort to address the needs of farmers. The experts tried to convey this view to tutors and extension officers.

3) Determining training needs

In phase 1, irrigated rice cultivation personnel from around the country participated in the training at KATC. Because the natural conditions and rice cultivation characteristics of the areas where the training participants came from were not clear, the tutors did not know what kind of rice cultivation the training participants were engaged in. For training to be effective under such circumstances, it is important for the tutors to understand the conditions and needs of farmers. Emphasis was placed on these points when transferring technology to tutors. In a questionnaire of eleven tutors who had worked on the project from phase 1, the tutors pointed out the following as the most important lessons they learned from the experts: "formulating training programs that meet the local needs" (10 replies), "clarifying needs of training" (9 replies), "collecting and providing information that is useful for irrigated rice cultivation" (4 replies), and "training technology in general" (4 replies). These replies indicate that the technology transfer emphasized clarifying the needs of farmers and creating a training program based on the needs.

Determining the needs of farmers and creating a training course corresponding to the needs are important elements of the training program. As for determining the farmers' needs, all eleven tutors who have worked on the project from phase 1 answered that they know the needs of extension officers and farmers. Out of the ten tutors who were hired for the first time for phase 2, two answered that they are not familiar with the needs of extension officers and one answered that he is not familiar with the needs of farmers. In

response to a question on how they learned the needs of extension officers, eighteen out of twenty-one answered, "through discussions in training course," which exceeded twelve that replied "local visits." The same trend was also seen for the needs of farmers. This indicates the importance of actually discussing the issues instead of merely visiting sites.

4) Responding to feedback from training participants

KATC conducts a survey among all the trainees upon completion of each training course, and revises the training materials based on comments from the survey.

(3) Financial aspect

1) Effort to expand KATC's farm area

As one of the measures to increase KATC's income, an effort was made to increase its farm area. Compared to other training institute, KATC had a small farm (see Table 4-5), making it impossible to produce and sell agricultural products as a source of income. Therefore, KATC wanted to purchase a neighboring farm of 1,800 ha and sell agricultural products from the farm and use the proceeds for KATC's operations. The farm was purchased by someone else, however, so the plan was never materialized.

2) Training services

In Tanzania, each research organization can use the income it earns as a self help fund (SHF) at its own discretion. As KATC has little income from crops, its principal source of income is revenue from its training services. Therefore, KATC has actively solicited training services to other organizations. Table 4-6 shows a list of training courses that it has provided for outside organizations.

Table 4-6. Training Courses Provided for Outside Organizations during Phase 1 Period (excerpt)

Period	Course	Province	Participants			Sponsor
			Male	Female	Total	
1997/5/26～6/4	Irrigation Extension	Arusha, Tanga, Iringa, Mbeya	18	2	20	RBMSIIP
1997/6/9～14	Rice Cultivation	Kilimanjaro	13	7	20	NAEPII
1997/7/21～25	Irrigation Scheme Management	Arusha, Tanga	18	12	30	RBMSIIP
1997/10/13～24	Rice Cultivation	Morogoro	14	6	20	SUA-TU
1998/4/6～24	Irrigation Scheme Management	Shinyanga, Dodoma, Tabora, Mwanza, Singida	24	2	26	SDPMA
1998/7/6～21	Irrigation Scheme Management	Tanga, Kilimanjaro, Arusha	27	5	32	RBMSIIP
1998/8/3～21	Irrigation Scheme Management	Iringa, Mbeya	27	15	42	RBMSIIP
1998/9/28～10/16	Irrigation Scheme Management	Tanga, Iringa, Arusha	20	10	30	RBMSIIP

RBMSIIP: River Basin Management and Small-holder Irrigation Improvement Project (World Bank)
NAEPII: *National Agricultural Extension Project Phase II (World Bank)*
SUA-TU: Sokoine University of Agriculture / Tuskegeensis Project
SDPMA: Small Holder Development Project for Marginal Areas
Source: JICA, 1999, Terminal Evaluation Report of the Kilimanjaro Agricultural Training Center Project, page 149 (In Japanese).

3) Burden of local costs

As the Tanzanian government allocated insufficient budget to KATC, JICA had to bear local costs. For example, in phase 1, majority of the training expenses was paid with JICA's project expenses. Under the structural adjustment program, there were cases when no routine expenses other than wages (salaries of

KATC personnel) were paid. As a result, the project had to incur increasing amount of expenses.

4.3.5 Outline of activities

(1) Outline of training project

The principal training courses developed in phase 1 are as shown below.

Target group	Course
Extension officers, District crop officers	Rice cultivation course
Irrigation technicians	Water management course
Agricultural mechanization officers	Rice mechanization course
Tractor operators	Tractor operator course
Farmers and extension officers	Key farmer course

Table 4-7 shows the number of individuals who have completed training by training course. Training target area was all of Tanzania. To allow farmers with similar irrigated rice cultivation conditions and extension officers to participate in training together, training was provided for one to three regions at a time. During the project period, the entire nation was covered.

Table 4-7. Number of Individuals Who Completed KATC Training (as of January 1999)

	Rice cultivation	Key farmer	Water management	Rice mechanization	Tractor operator	Use of Azolla	Training with external funding	Total
1994	0	0	0	0	0	0	0	0
1995	18	25	22	0	9	0	0	74
1996	38	145	19	15	8	0	0	225
1997	39	127	31	8	21	25	90	341
1998	30	108	51	16	7	26	130	368
1999	0	23	0	0	0	0	0	0

Source: JICA, 1999, Evaluation Report at Project Completion of the Kilimanjaro Agricultural Training Center Project, page 149 (In Japanese).

(2) Features of training courses in phase 1

1) Training that is simple and easy to understand

The training courses were designed to be as simple as possible. The basic message to improve rice cultivation is to grow rice so that the size of ripened grains is even. To this end, the training emphasized the importance of consistency in rice variety, seeds, germinating conditions, seedling management, leveling, soil fertility, planting density, water management, and growth. Such consistency is visible and easy for farmers to understand. For example, a farmer from Arusha immediately applied the techniques he learned in the KATC training with the support of an extension officer. As he learned that he could increase yield per acre by standardizing water management and fertilizing by dividing a paddy field into same-sized plots, he used the techniques and obtained a higher yield. As this example illustrates, teaching rice cultivation in ways that are easy for anyone to understand helped the techniques to be disseminated.

2) Practical training in the field

Training emphasized hands-on lessons on KATC's trial farm. For example, in the case of key farmer course, class room lectures accounted for only 31% of the entire course. Hands-on training accounted for 48% (Table 4-8). To see the effectiveness of new technology with their own eyes, the participants visited farms with high crop yield by using new technology in Lower Moshi irrigation scheme or on farms outside of the scheme without modern irrigation facility.

In a questionnaire, 20 out of 21 tutors pointed to "hands-on training on the farm" as the most effective training method for extension officers and farmers. When asked about what type of training was effective for extension officers, the tutors replied, "field training" (16 replies), "discussion between participants" (16 replies), and "farm visits" (15 replies). On the other hand, only four replied "class room lectures." When asked which types of training are effective for farmers, the tutors replied, "hands-on training on the farm" followed by "farm visits" (19 replies) and "joint training with extension officers" (16 replies). Here, too, only three replied "class room lectures," indicating that the tutors feel that hands-on training is more effective than classroom lectures.

When extension officers, who participated in the training, were asked what part of the training helped them the most, eleven out of thirteen of those who replied said, "hands-on training on the farm." It was followed by "farm visits" and "joint training with key farmers" (6 replies each). Only three replies and two replies were given for "class room lectures" and "training text," respectively. Therefore, it can be seen that extension officers, too, felt that hands-on training and visits are important to improving technical capacity.

The same can be said for farmers. Of the 53 key farmers from Lekitatu, Mombo, and Mwega, 45 replied that "farm visit" was the most effective component of the training. It was followed by "discussion between training participants" (44 replies) and "hands-on training on the farm" (43 replies). Other replies were "joint training with extension officers" (38 replies) and "training text" (37 replies).

3) Extension in the framework of training

In phase 1, "improvement of extension method" was one of the activities. Therefore, the project prepared an extension improvement plan in the rice cultivation course catering to extension officers in an effort to achieve as much extension as possible within the framework of training.

4) Emphasis on demonstration farm

In the training, tutors taught the extension officers and farmers that in extension, it is effective to use demonstration farms that other farmers can actually see. When extension officers have no place or equipment, they were instructed to make a demonstration farm by using the land of a key farmer. The tutors told the trainees that a small demonstration plot would suffice as a demonstration farm. The tutors also told the trainees that, in extension, it is not necessary to target all the farmers in the irrigation scheme from the beginning, but to select about ten farmers who are eager to introduce new techniques, and instruct these farmers.

Creation of a demonstration farm is actually an effective method. In Lekitatu, after the training was completed, five demonstration farms, one for each canal, were created. Key farmers were placed in charge of work on these demonstration farms. The size of each demonstration farm was set to 0.5 acre to

make it easy for farmers to convert measurements for their own farm. In Kwemazandu, Korogwe District, key farmers who participated in training used their own farms as demonstration farms to transfer technology to other farmers. In Mkindo, Morogoro Rural District, technology transfer is under way to Dihombo, a neighboring village. A demonstration farm in Dihombo's farm is playing an instrumental role in the technology transfer. Key farmers from Mkindo work on the demonstration farm.

5) Joint training

Joint training (key farmer course) was held for extension officers and farmers to receive training together. The decision to hold the joint training was made when, during a preliminary study, Tanzanian officials commented that training would not be successful unless farmers, in addition to government personnel, participate in the training. While some parties felt that such a joint training would not be feasible, many extension officers who participated in the key farmer course supported the idea. Experts who participated in the project praise joint training as a highly effective method of training.

6) Locally accessible training aid

For training, locally accessible materials and equipment were used. For example, a poster was used instead of a video, as the latter cannot be used on the farm.

(3) Outline of key farmer course[5]

This section provides an outline of the key farmer course which is one of the training courses offered in phase 1. The key farmer course was originally two weeks long, but from fiscal year 1997, the course was lengthened to three weeks. Each training class catered to 25 trainees, and six classes were held per year. Concerning the enrollment and selection of farmers, when phase 1 began, Japanese experts traveled around the country with counterparts to find key farmers. However, it was not easy to determine what types of farmers would be appropriate as key farmers. Therefore, KATC decided to have extension officers select farmers who would be appropriate as key farmers in their areas. To be more specific, KATC first trained the extension officers, discussed the selection criteria of key farmers with extension officers during the training, and asked the extension officers to select farmers who meet the criteria. The selection criteria of key farmers presented to extension officers are as follows:

- Skillful and interested in advanced technology
- Able to read and write
- Owns a paddy field
- Able to convey knowledge to other farmers
- Has at least some money
- Eager to improve rice cultivation in the area
- Trusted not only by extension officers but by village people and village leaders

Each extension officer selected three key farmers according to the selection criteria from the irrigation scheme which he has been placed in charge, and then received training again at KATC with the key farmers. Joint training not only improved the irrigated rice cultivation technology of key farmers, but also improved the communication and sense of trust between the extension officers and farmers as they lived together during the training period. As a result, they were anticipated to jointly promote extension activities after

[5] The information provided in this section is based on KATC Newsletter "Rice and People in Tanzania," Vol. 4 (June 1997), Vol. 6 (December 1997), and Vol. 11 (March 1999) (In Japanese).

they returned to their irrigation schemes. By participating in the training with the key farmers, extension officers were expected to improve their sense of solidarity with farmers and become aware of their responsibility as area leaders. Table 4-8 shows the details of key farmer course.

Table 4-8. Outline of KATC Phase 1 Key Farmer Course

Subject	Topics	Method (Unit)			Total	
		Lecture	Practice	Others		(%)
Rice cultivation	Rice varieties and seeds Rice cultivation practices Processing and storage	5	9	0	14	(33)
Agricultural extension	Farmers' groups and meetings Extension teaching methods Farm record keeping Family nutrition Health hazards	4	4	0	8	(19)
Water management	Tertiary unit water management Irrigation system management Water user's association	2	5	0	7	(17)
Agricultural machinery	Introduction and utilization of agricultural machinery	2	2	0	4	(10)
Study trip and farm visits		0	0	9	9	(21)
Total		13	20	9	42	
	(%)	(31)	(48)	(21)		(100)

Source: KATC Information Booklet on Training Courses 1999/2000.
Note: 1 unit is 1.5 hours.

(4) Outreach training and follow-up guidance[6]

Although phase 1 was scheduled to end in 1999, evaluation at project completion found that follow-up guidance and outreach training sessions for the farmers who had completed training had not been conducted. Therefore, phase 1 was extended for two years. Although outreach training session was not included in the initial plan of KATC, it was added as an attempt to support extension activities in the field. Follow-up guidance was provided to evaluate the performance of training participants and to determine how the training at KATC meets the needs. The outreach training sessions held with the follow-up guidance provided training to 557 farmers and 48 extension officers during the two years.

Although the residential training at KATC gathered participants from regions with as similar cultivation environment as possible, it was found that the participants faced different situations. Therefore, although the training aimed to provide practical knowledge, tutors were forced to provide general, basic information, and could not necessarily address the issues that are specific to each area. Filling this gap was another purpose of the outreach training sessions. An outline of outreach training sessions is provided below.

Target: 30 individuals including rice farmers and extension officers (per location)
Period: 5 days
Description: Day 1 Problem analysis
Brainstorming of problems and narrowing down problems
Day 2 to 4 Training session
The theme of each session is a specific issue, and a person who has completed the training (extension officer or key farmer) generally served as the tutor. The training site was the farm whenever possible.

[6] The information provided in this section is based on KATC Newsletter "Rice and People in Tanzania," Vol. 14 (April 2000) (In Japanese).

Day 5 Created an action plan, set the specific measures that extension officers and farmers should work on, and all the participants agreed on the measures.

This outreach training session has been praised by farmers. For example, farmers in Lekitatu commented that the outreach training allowed them to learn what they had missed in the residential training at KATC and to ask the tutor about problems that arose in practice. The farmers also commented that having a tutor from KATC watch them using the techniques that they had learned improved their morale. In a questionnaire of 21 farmers from Lekitatu, out of the seventeen farmers who participated in the outreach training session, twelve replied that the outreach training session was more effective than the training at KATC (opposing comments by four respondents and no answer was provided by one respondent). When asked why the outreach training session was more effective, fifteen answered, "allows more farmers to participate." Nine respondents answered, "the suggested techniques are suited to local needs."

Extension officers also pointed out the importance of the infield sessions held in phase 1 and phase 2. All twelve extension officers of the irrigation scheme praise the importance of field training sessions in disseminating technology. When asked what aspects of field training sessions are superior to the training at KATC, ten replied, "allows many farmers to actually see irrigated rice cultivation technology" and ten replied, "allows farmers to learn from the experience of other farmers." Seven replied, "reflects local needs."

4.3.6 Review of approach

A field training session conducted during the follow-up period to phase 1 revealed that dissemination of the techniques taught in training is limited. One of the reasons was that although the farmers and extension officers who participated in the training could practice what they learned themselves, they could not teach others the techniques. A problem was also detected in how key farmers are selected. For example, in one area, an extension officer brought only his relatives as key farmers. In another area, when KATC encouraged participation by female farmers, an extension officer brought his wife. On other hand, in other areas, extension officers held meetings to report to farmers what they have learned in training, and organize continuous study sessions. In such areas, rice cultivation technology improved considerably.

While a brief review has been conducted on phase 1 through follow-up guidance and outreach training sessions, there has been no systematic review to evaluate the output and approach of phase 1. KATC tutors and experts alike feel that while the role of key farmers concerning technical dissemination was taken into account in the selection criteria of key farmers for phase 1, the mechanism for ensuring the dissemination from extension officers and key farmers to other farmers was not necessarily established.

The study team visited six irrigation schemes that sent farmers and extension officers to phase 1 training.[7] As a result, the mission found that while the techniques learned in training have been disseminated to other farmers in Lekitatu, Kwemazandu, and Mkindo, the techniques learned in phase 1 were disseminated only to a limited extent in Mombo, Mahenge, and Mwega.[8] These findings suggest

[7] The six irrigation schemes were Lekitatu, Arusha; Mombo, Korogwe; Kwemazandu, Korogwe; Mahenge, Korogwe; Mkindo, Morogoro Rural; and Mwega, Kilosa.

[8] Since Mombo and Mwega were chosen as model sites for phase 2, and field training sessions have been held there, techniques have now been disseminated in those areas. Mkindo has a farmer training center, and various activities with the support of FAO and Indonesia take place there. Therefore, the degree to which KATC's training has helped technical dissemination in Mkindo is hard to evaluate.