III Activities and Results of the Project

1. Project plan, activities and results by specialities

1.1. Integrated agricultural and rural development

(1) Basic policies

Indonesia has not enacted laws regarding the use of land. A related law, an ordinance regarding village development planning titled "Law 5 Regarding Rural Administration," was enforced in 1979. This law prescribes the population and number of households of villages, and the establishment of a village office for administrative affairs, mosques, roads for economic exchanges, transportation, and a market, as well as providing villagers with means of livelihood. This development law lays down the basic development plan for villages. Except for a few roads, there are no concrete development projects for the villages in the district covered by this project. Moreover, with regard to the establishment of land use plans for the district, the director of the BAPPENAS (National Development Planning Agency) has requested that agricultural development planning be established taking into consideration the future development of villages.

Such villages consisting of farms are to form spontaneously along highways, with a village office, mosque, and sports ground in their center.

This project consists in performing a model implementation of agricultural development for a total of eight villages. The model development pattern for these villages has been adapted and expanded for each village, based on the basic policy that the establishment of a master plan modeled on the future image of these villages is necessary.

(2) Agricultural land use plan

The development plan for the eight villages participating in the project was drafted based on the results of a study by related parties including farmer representatives, village heads, county heads, and so on.

The project's agricultural development project area is to be unused land (alang-alang grassland) located behind relatively crowded farmland and the project is to consist in the development of a mixed-wood land.

The reclamation area for paddy fields includes level grassland as well as low-lying wetlands that risk being flooded at the peak of the rainy season. Nonetheless, the paddy field reclamation area is topographically suitable. The upland field reclamation area consists of gentle hills of alang-alang grassland, and sloped areas are not to be reclaimed. The estate crop is to be

grown on mixed-wood land at the foot of a mountain, mainly on relatively dry land.

The land use of the villages as indicated above is shown in Table 3-1. The farm land development of paddy field, up land and estate land are to be established based on a comprehensive consideration of a number of factors, including the development potential judged from the viewpoint of the farm size, the topography and the soil, as well as the availability of irrigation water. These lands are all privately owned, and the beneficiary lands of the project are to be grouped in one part within the village, serving as the trigger for further expansion into the surrounding areas.

(3) Farm land development and environmental preservation

While development is necessary for developing countries, it is increasingly recognized that the preservation of environmental resources is the basis for sustainable development. Agricultural development accompanied by land development in particular is considered to involve important changes regarding the use of renewable resources, and the impact on the surrounding environment is viewed as a problem.

The developments in this project involve as a condition the implementation of sustainable development with full consideration given to the environment. With regard to upland cropping and the development of estate land in particular, to prevent soil erosion and soil runoff, this project is to avoid the denudation of large tracts of land and will seek to eliminate concentrated surface water drainage while establishing a suitable number of green zones.

Moreover, it is necessary to consider how to avoid excessive new development by place priority on activities to develop techniques for the efficient use of land, such as multiple cropping on existing farm land, and letting land lie fallow.

On the other hand, mix-planted areas next to streams and consisting of sago, cocoa tree plantings, and cashew nut trees, cassavas are located in harmony with the cultivated environment at the periphery of villages, and they are managed and preserved as precious local resources as part of the preservation of the village's living environment and panorama.

Table 3 - 1 Land Use Plan by Village

Lalobao Village

Unit: (ha)

Existed / Plan	Farm Land			Fallow Land			Total
	Paddy field	Upland	Estate land	Mix-planted areas	Grassland	Mixed-tree area	
Paddy field	26				120		146
Upland		150					150
Estate land					50		50
Mix-planted areas				575			575
Grassland					5887		5887
Mixed-tree land							
Total	26	150		575	6057		6808

Lapulu Village

Unit: (ha)

Existed / Plan	Farm Land			Fallow Land			Total
	Paddy field	Upland	Estate land	Mix-planted areas	Grassland	Mixed-tree area	
Paddy field	139				100		239
Upland		175					175
Estate land					80		80
Mix-planted areas				561			561
Grassland					3116		3116
Mixed-tree land							
Total	139	175		561	3296		4171

Sabulako Village

Unit: (ha)

Existed / Plan	Farm Land			Fallow Land			Total
	Paddy field	Upland	Estate land	Mix-planted areas	Grassland	Mixed-tree area	
Paddy field	7				50	200	257
Upland		151					151
Estate land			92				92
Mix-planted areas				153			153
Grassland					31		31
Mixed-tree land						897	897
Total	7	151	92	153	81	1097	1581

Ranometo Village

Unit: (ha)

Existed / Plan	Farm Land			Fallow Land			Total
	Paddy field	Upland	Estate land	Mix-planted areas	Grassland	Mixed-tree area	
Paddy field	72					150	222
Upland					2		2
Estate land			79				79
Mix-planted areas				32			32
Grassland					167		167
Mixed-tree land						98	98
Total	72		79	32	169	248	600

Onewila Village Unit: (ha)

Existed / Plan	Farm Land			Fallow Land			Total
	Paddy field	Uplands	Estate land	Mix-planted areas	Grassland	Mixed-tree area	
Paddy field	7				85	15	107
Upland		56					56
Estate land			149				149
Mix-planted areas				34			34
Grassland					15		15
Mixed-tree land						141	141
Total	7	56	149	34	100	156	502

Palanga Village Unit: (ha)

Existed / Plan	Farm Land			Fallow Land			Total
	Paddy field	Upland	Estate land	Mix-planted areas	Grassland	Mixed-tree area	
Paddy field	60				120		180
Upland							
Estate land					80		80
Mix-planted areas				640			640
Grassland					493		493
Mixed-tree land						807	807
Total	60			640	693	807	2200

Kiaea Village Unit: (ha)

Existed / Plan	Farm Land			Fallow Land			Total
	Paddy field	Upland	Estate land	Mix-planted areas	Grassland	Mixed-tree area	
Paddy field	30				200		230
Upland		271			70		341
Estate land							
Mix-planted areas				246			246
Grassland					549		549
Mixed-tree land						604	604
Total	30	271		246	819	604	1970

Laeya Village Unit: (ha)

Existed / Plan	Farm Land			Fallow Land			Total
	Paddy field	Upland	Estate land	Mix-planted areas	Grassland	Mixed-tree area	
Paddy field							
Upland		137				50	187
Estate land						130	130
Mix-planted areas				106			106
Grassland							
Mixed-tree land						95	95
Total		137		106		275	518

(4) Project Implementation

The project started on March 1, 1991, but delays in the dispatch of experts and in the arrival of provided equipment such as construction equipment, as well as delayed budget directions, caused the project's implementation to fall behind schedule during the initial stage. However, the project went on track gradually, and implementation activities started making progress.

The goals of this project as set in the records of discussion (R/D) are "To introduce techniques and knowledge for agricultural and rural development in agricultural regions that are underdeveloped, appropriate for the natural and social conditions of the region; and through this, to achieve improvements in agricultural productivity and crop diversification, contributing to raising income levels of farmers and improving their living standards." Moreover, the R/D define the project itself as a "model" development, wherein farmers participate in project activities.

The goal items of the project remained unchanged from the commencement of the project.

The direct stated goals of the project are "the introduction of technology and knowledge," which ties to "productivity improvements and crop diversification," and leads to the higher goals of "income level and living standard improvements."

(5) Activities and the results

a) Land use plan

The status of farming technology at each village was investigated in addition to surveys regarding the status of irrigation, land use, rural roads, and so on, required for decision-making for the integrated agricultural and rural development project for the eight beneficiary villages, and based on cooperation with related persons of the region, the development diagrams were established.

With regard to decision-making for land use, talks were always held with related persons at the local level. In the case of Ranometo Village and Palanga Village, land use plans were established for the development of paddy field and upland through the use of alang-alang removal techniques. In particular with regard to planning methods for the above items, manuals were prepared and technology transfers to counterparts at the MOA and province level were performed.

b) Agricultural and rural infrastructure development plan

i) Contents of activities

Topographic surveys, river surveys, and control point surveys covering a total project implementation area of 1,090 ha were conducted, and 1:5000 scale topographic maps were prepared, and the methods for performing the above were transferred to counterparts. Moreover, based on the results achieved, land reclamation planning methods including the use of heavy machinery, and technologies related to basic agricultural infrastructure such as irrigation and drainage facilities and roads, were transferred.

Table 3 - 2 Status of Basic Agricultural Infrastructure

Implementation Year	Implementation Area by Village
FY1991	Ranometo Village: 200 ha Palanga Village: 150 ha Subtotal: 350 ha
FY1992	Kiaca Village: 200 ha Lalobao Village: 100 ha Subtotal: 300 ha
FY1993	Sabulakoa Village: 170 ha Onewila Village: 150 ha Subtotal: 320 ha
	Total: 970 ha
(Specs.) Scale: 1/5000 Contour intervals: Flat areas: 1 m, Hilly areas: 5 m	

Furthermore, transfers of technologies related to planning for facilities required for farming activities (extension work offices, farmers' meeting places, rice mills, drying facilities, livestock markets, demonstration fattening yards, and seed storage facilities) were also performed.

ii) Results and impact of activities

Survey

Because the project implementation area ranges a wide area and early surveys were desired, the use of local consultants was decided. At this time, a list of survey implementation items required per the contracts to be used were prepared, and counterparts comprehended the main points regarding specifications and bidding.

Planning

The designs and estimates for land reclamation using bulldozers and back hoes have been comprehended by counterparts. Furthermore, the participation of farmers in the implementation of works was required in this project, and accident insurance was introduced to provide against the risk of accidents.

With regard to agricultural infrastructure planning, the method for preparing estimates for irrigation facilities, bridges, ancillary buildings, and so on, was determined through talks with the province's Public Works Office. The location of water intake points, and alignment of canals and rural roads in particular was determined only after a process of repeated explanations at the local level.

Until then, the district did not have separate offices for extension workers, and in order to perform continuous farming guidance, it was decided to build such offices, which would also have an attached village meeting halls made necessary by the project's emphasis on maintaining an ongoing dialog with farmers. These new offices were received enthusiastically. Moreover, along with the expansion of the total paddy area, rice mills operated by the farmers themselves were established, which contributed to raising farmers' income level.

In order to contribute to the improvement of stockbreeding and fattening, areas that from the start showed promise in the project implementation district, as well as disease prevention, livestock markets (Laeya Village and Ranometo Village), demonstration fattening yards (Palanga Village, Laeya Village, Sabulakoa Village, and Ranometo Village) were established with full thought given to cost. Moreover, storage facilities for soybean, corn, and so on, were built incorporating a number of ideas such as using styrofoam as thermal insulator to create structures that would ensure constant temperature and humidity, and selecting designs for good ventilation, and so on.

Also, the construction of community wells greatly contributed to alleviating the workload of women and children and was very favorably received as desirable improvements from the perspective of WID (Women In Development).

c) Farming plan

Surveys were performed on the state of agriculture for establishing the appropriate technological level, and the locations and scale of experiment and demonstration farms were established taking into consideration the farming modes and technological level of immigrants, settlers, and original residents, which are characteristic of the project district.

Further, the following six types of farming plans for the eight beneficiary villages were established as the farming modes to be introduced in the project district.

Table 3 - 3 Farming Plans for Eight Villages on Project Site

District	Village	Development Type
Ranometo	Ranometo	Integrated agricultural development for suburban areas
	Onewila	Development of paddy field through improved drainage
Palanga	Palanga	Integrated management of paddy, upland cropping, and estate cropping
	Kiaca	
Tinanggea	Lalobao	Integrated agricultural development of centering on upland cropping
	Lapulu	
Laeya	Laeya	Development centering on upland cropping, estate cropping, and stockbreeding
Landono	Sabulakoa	Paddy field development

The establishment of land use and farming plans was done in close coordination with the efficient use of water resources, introduction of crops and water management methods, and so on, in the region involved, and planning methodology will have to be taught further to counterparts in the future.

Furthermore, precise surveys are made difficult by the fact that the agricultural

development area in this project borders on wetlands and mountain areas, and thus the timely preparation of 1:5000 scale topographic maps by the Indonesian Government is desired.

1.2. Infrastructure development plan

(1) Development plan

The project area consists of eight villages in five counties, in the southwestern part of Kendari district in the Southeast Sulawesi Province. Following consultations with the Ministry of Agriculture, provincial government officers and village representatives, local conditions at the eight villages (land use, agriculture, development of infrastructure, living conditions etc.) were investigated, and taking into consideration the agricultural development potential of each village, its topography, conditions of water for irrigation etc., an overall planning was prepared and the project areas were selected.

a) Development plan for farming land

During its implementation period, this project will accomplish land leveling, plowing, upside down plowing, and harrowing through the guidance of JICA experts for 170 ha of paddy field and 60 ha of upland and estate land out of a total potential area of 1,040 ha for paddy field and 460 ha for upland and estate land, using heavy machinery for farm land development provided by the Japanese government. The project will also make to reduce labor force for reclamation work and built ridges actively between paddy fields through communal work, and in the process, promote the strengthening of training for farmer organizations while raising the awareness of the government side about the necessity of reclamation using machines.

b) Development plan for irrigation facilities

This project will use mainly human power to build and repair intake weirs required for the development of paddy fields (11 locations), and irrigation canals (approximately 25 km) as well as drainage canals (approximately 5 km). One part of the excavation work was performed with machines in order to perform technical guidance on construction using machines.

The construction of ancillary facilities for main canals and diversion structures are all to be implemented using mainly human power. The required construction materials (cement, stones, sand) are to be procured/purchased locally. The construction costs for intake weirs, main canals etc., are to be borne from Japnaese side, but the construction of tertiary canals for realizing appropriate water management and water distribution in particular is to be done through joint work with farmers (Gotong Royong system).

On the other hand, Indonesia has a comparatively high standard of public-work related to an irrigation technology and the construction of hydrauulic structures. Although this project is conducted principally by the Ministry of Agriculture of Indonesia, exchanges of views with provincial government officers from the Ministry of Public Works have been taken at each investigation stage. The Japanese side was requested to provide guidance on dewatering and cofferdam method, design methods for works such as gates, as well as decision methods for machinery requirement per unit work. The main aim of this project regarding technical guidance is the improvement of agricultural productivity and the training of farmers' organizations through agricultural development, and cooperation with organizations related to the Ministry of Public Works regarding technological transfers during the implementation of this project is deemed necessary.

This project also aims to strengthen water user's associations and provide training regarding water management techniques and farmers' organizations.

c) Development plan for farm roads

This project aims to develop the minimum required road network for the transportation of the farming equipment introduced for this project and for the collection and shipping of produce. With regard to current conditions of farm road use, this project plans to construct bridges (using wood) and crossing conduits to eliminate factors that inhibit traffic, and for the time being will build strictures using the materials currently at hand.

The project's road plans consist in mending the alignment and slope of some roads, with plans to introduce construction equipment provided by Japan for saving manpower for the construction of embankments for roads through joint work by farmers. The project will also provide guidance on training farmers' organizations through the above construction works.

d) Agricultural facilities

This project is to construct the following facilities: Livestock markets (2), demonstration fattening yards (5), seed storage facilities (5), rice mills (8), training facilities (13), drying facilities (40), and community well facilities (40). This project is to provide training and guidance to farmers' associations through the construction of these agricultural facilities.

(2) Appropriate technology for agricultural land development

The project area has large tracts of unused land and fallow land, including large areas of abandoned burnt fields and cut-over areas that have turned into alang-alang grassland. In particular, abundant growth of alang-alang prevents trees and plants from growing and therefore impedes the transition of plants, and the land such afflicted cannot be reforested and is thus left alone.

The farmers in the project area use mainly hand farm implements and manual labor, and sometimes simple animal-powered equipment (plowing using two- heads of cattles) to develop fields. However, converting these fields into well plowed land using only human and animal power is not easy, and removing alang-alang using only human power requires tremendous effort, and this constitutes a major factor in blocking the agricultural development of this area.

In Indonesia, the development of the agricultural infrastructures, such as irrigation facilities, is a major matter of national policy, which is principally administrated by the Ministry of Public Works. On the other hand, the Ministry of Agriculture, which is in charge of agricultural development, has no institutional set up of a development land and leaves development up to autonomous joint work by farmers. Therefore, when farmers decide to expand their farm land, they are faced with insufficient manpower and funds, and run into the wall of not being able to realize the irrigation area planned by the Ministry of Public Works. To overcome this situation, the Indonesian Government, particularly BAPPENAS (National Development Planning Agency) has made insistent requests to the Japanese Government for technical cooperation for the development of paddy fields and upland.

While land reclamation using equipment has been widely accepted by farmers in Japan through various changes, the project district in the Southeast Sulawesi Province has had no such experience. As a result, it is deemed necessary to divide the development plan into several steps and combine it with training for the MOA officers to be involved. Lands suitable for this project's land reclamation are of vast scale. If such a wide area were to be reclaimed in Japan using heavy machinery with large horsepower, a long period would still be required to train farmers' associations in how to convert these new paddy and field lands into mature paddy field and fields. Therefore, in planning this project, it was judged desirable to form it as long-term and large-scale planning model based on the level of farmers and the state of the local agriculture. Consequently, a development plan was established whereby cooperation from Japan is to be aimed at reclaiming part of the currently abandoned land by using equipment, while the Indonesian side is to invest the wages of farmers obtained through this reclamation work in raising the land productivity.

(3) Development of irrigation facilities

Various data and informations related to meteorological, hydrological and other materials required for the irrigation development planning were collected and studied. Calculation of probability on effective rainfall were done based on the 10 years record from 1980 to 1989 at Kendari Airport Meteorological Observation Station within the project area. Under the criteria of non-effective rainfalls of less than 5 mm and higher than 50 mm, per day rainfall between 5 mm and 50 mm were collected. The average annual rainfall for this district is 1,870 mm or higher, and the base year corresponding to non-exceeding probability rate 1/5 year (1,605 mm) was calculated to be year of 1983. Furthermore, 80% of the rainfall is concentrated in rainy season between November to July. The project aims for double cropping of paddy, using the gravity irrigation method. Since topographical maps and basic rainfall data for the project were not available, the runoff was estimated based on the figures for similar regions through consultation with the provincial Public Works Office.

Maximum annual runoff = $0.1 \sim 0.3 m^3/sec/km^2$

Minimum annual runoff = $0.5 \sim 2.0 m^3/sec/100km^2$

Average monthly runoff = $0.5 \sim 1.0 m^3/sec/100km^2$

Moreover, the irrigation water requirement was estimated based on peak water requirement of 1.65l/sec/ha, and various calculations on irrigation planning are to be performed depending on the area to be irrigated.

The irrigation plan for the project is to repair existing intake weirs and canals as well as construct new facilities. Irrigation facilities are to employ the design standards of Indonesia, and the construction of the weirs is to be used a mortar wet masonry, which is popular in the Southeast Sulawesi Province for irrigation structures and road ancillary facilities.

(4) Development of agricultural facilities

a) Seed storage

These facilities are used to store the seeds grown by farmers in a cool place with low temperature variations. Usually, farmers are very careful about seed storage because inadequate storage conditions can cause a markedly lower germination rate. It is considered that if following their harvest, seeds have a high moisture content and are exposed to high temperatures, this induces continued enzymatic activity that contributes to lowering their germination rate during the next planting season. Therefore, seeds must be well dried, stored in a low-temperature place, in other words they should be placed in a dormant state. However, such control is difficult in high-

temperature, high-humidity tropical zones, soybeans in particular lose their germination power to a remarkable extent when left under natural conditions, thereby greatly affecting the next crops.

According to research done by experts belonging to the Agricultural Research Reinforcement Project of the Agricultural Research Development Agency, harvested grain loses up to 6% of its moisture content when exposed to the sun for 10 hours. By then placing the grain in tightly closed vinyl bags, it is possible to maintain it dry. It has been confirmed that grain can retain its germinating power for one year or longer if the vinyl bags are then stored at a temperature of 20℃ to 22℃.

The storage facilities used are structures consisting of concrete with heat insulating material placed in between, with a hermetic door closed from the outside. Shelves are provided on the inside, on which vinyl bags containing the grain of each farm are lined up. The structures are topped with a simple roof to prevent direct exposure to the sun.

b) Drying facilities for agricultural products

The quality of agricultural products such as rice falls considerably unless they are dried as soon as possible. Traditionally, farmers have had almost no interest in the quality of agricultural products. However, as the market economy developed, price has come to systematically reflect quality. Drying facilities are thus required for ensuring full drying of harvested agricultural products.

The surface of the earth is laid over with concrete to obtain an area with good drainage. A total surface area of approximately 250 m^2 (10x25 m) is desirable. Moreover, the erection of a simple vinyl house to serve as protection during the rainy season to ensure drying should also be studied. Dry yards of this type have been calculated to accommodate the production of approximately 30 ha of dry season paddy field considering some 15 tolerable days of paddy threshability.

c) Development of livestock facilities

The southwestern area of the Kendari division contains large tracts of unused land suitable for stockbreeding, but it is deemed to be too early to create meadows on a large scale considering current stockbreeding conditions, particularly the amount of meat consumption within the province, breeding technology, the funding ability of farmers, land ownership, and so on.

Therefore, it has been determined to develop the following facilities for the purpose of improving the stockbreeding environment based on existing local conditions.

i) Demonstrating fattening yards

These are small-scale demonstration yards holding 10 heads of cattle for fattening, one of which is to be set in each agricultural extension center and one in each village, and which are to serve for the dissemination and propagation of fattening techniques, forage crops, and stockbreeding technology.

The provincial government is currently drafting plans to alleviate the financing burden on farmers within the project area who wish to start livestock fattening operations, by original cow loan project. This assistance plan should make it relatively easy for small farmers to participate, both in terms of technology and funding.

ii) Livestock markets

Currently, there are no livestock markets in the Southeast Sulawesi Province, and due to spot sales, fair pricing is lacking. This is one of the factors that holds back farmers from shifting from draft cattle to beef cattle, although the number of heads of cattle per farm is relatively high. Moreover, the fact that cattle traders have to visit each village would make it difficult to secure the required number of heads of cattle for the existing demand (especially for shipping out of province). With regard to cattle hygiene, although the current status of cattle diseases can be grasped only at slaughter house and livestock quarantine stations, examination of livestock at livestock markets enables detection of the areas where cattle diseases break out.

(5) Activities and the results

a) Development of agricultural infrastructure

i) Contents of activities

1) Land reclamation

The development of paddy fields, experiment and training farms, and estate crop plantations through reclamation work using equipment was implemented. Prior to the reclamation, the topography of the land was established through plane table surveys and cadastral maps were drawn.

With regard to the arrangement of farm plots for the reclamation of paddy fields, between 1,000 m^2 and 1,500 m^2 were aimed for per plot, based on the mechanization level and the level of information of farms in the district. To ensure proper management of these projects, process control using bar charts and work progress control using plane tables were implemented after performing sufficient technological transfer to counterparts.

Regarding paddy field reclamation

- Selection of locations

  The lands selected by local farmers in each village following local briefing sessions were for the most part lands that had been abandoned as being to difficult to reclaim using human and animal power, such as low-lying wetlands, grown over by tall wetland grasses and palm trees (called "Sagu"), and alang-alang grass plains.

- Survey of existing conditions

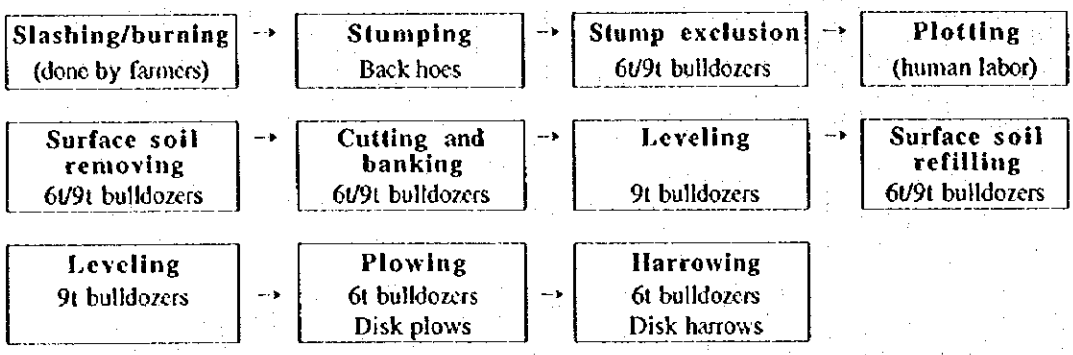
  Surveys of the original land consisted in planimetry using plane tables. Area mensuration was performed using the diagonal and perpendicular method was employing the planimeter method.

- Plotting plan

  As a rule, irrigation water was taken from the intake weirs or headworks built during the project, and irrigation canals and drainage canals (coupled with rural roads) were placed in a horizontal layout so as to improve plot-to-plot irrigation as much as possible.

- Determination of reclamation method/construction procedure

  The reclamation procedure employed is as follows.



- Guidance regarding reclamation technology for operators

  Various types of guidance, from instruction on how to fill daily work reports (mainly work times, work contents, equipment maintenance inspections, hour meters, and fuel and oil refill amounts), to operation technology, were provided at each village. The following three items related to operators' operation technology remain to be handled.

  1) Construction method for weak soil (heavy equipment among provided equipment is for dry soil.)

  2) Creation of dry soil through excavation of temporary drainage canals using back

hoes

3) Extraction method for heavy equipment that gets stuck in wetland areas

- Surveys of completed works

Since these surveys are performed using plane table survey equipment and are quite easy to do, counterparts have a good understanding of how to perform them. Moreover, as the area of the plots of land in the district are measured with a polygonal area calculation method, the method was employed whereby the lateral and longitudinal measurements are simply averaged and then multiplied by the height. However, experts pointed out that this method was efficient when the superior extremity and the inferior extremity of trapezium are parallel, but that in other cases, it did not yield a correct value, and therefore people were instructed to use the diagonal and perpendicular method and perform checks with a planimeter.

Further, the experts also prepared introductory textbooks in Indonesian on area calculation methods including standard surveys and plane table surveys as aids for the transfer of these technologies.

Table 3 - 4 Area Statistics of Reclaimed Paddy fields

Village	Reclaimed Area (ha)	Number of Owners	Number of Plots	Area per Plot (m2)
Lapulu	5.0	11	27	1,851
Lalobao	7.0	11	50	1,400
Sabulakoa	5.0	11	50	1,000
Onewila	1.0	4	11	909
Total	18.0	37	135	1,333

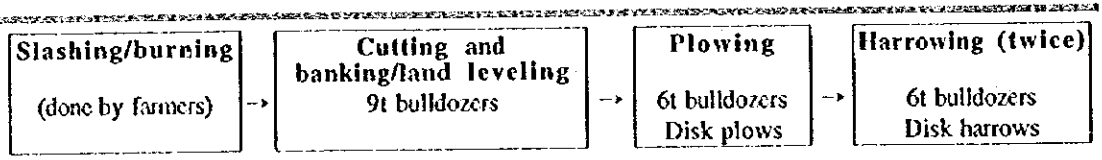
Experiment and demonstration farm and estate crop plantation reclamation

- Selection of locations

Locations were selected taking fully into consideration the opinions of farmers through briefing sessions similar to those held for paddy fields reclamation. Most of the candidate locations were gentle slopes densely covered with alang-alang weeds requiring the development of alang-alang weed removal techniques. However, stands did not exceed the level of shrubbery, and therefore root replacement was deemed unnecessary.

- Determination of reclamation techniques/construction procedures

The following reclamation procedure was employed.



- Experiment and demonstration farms and estate crop plantation reclamation

  The reclamation areas are as shown in Table 3-5.

Table 3 - 5 Experiment and Demonstration Farms and Estate Crop Plantation Reclamation Status

	Ranometo	Palanga	Kiaca	Laeya
Experiment and demonstration farm	2.1ha	2.5ha	4.5ha	4.8ha
Estate	2.0ha	1.0ha	1.0ha	2.2ha

2) Agricultural infrastructure

With regard to the agricultural infrastructure, rural roads (42.5 km), reservoirs (10 locations), culverts (12 locations), and rural bridges (12 locations) were built through directly managed work. In particular for the excavation of irrigation canals, work was directly managed by farmers' groups (irrigation canal length = 8 km), and the technology being transferred in the process. Moreover, weirs and other irrigation facilities were done through contract work.

Development of rural roads

Rural roads linking villages and experiment and demonstration farms were built using the provided equipment. The routing, breadth, and structure of the roads were determined through discussions at briefing sessions similar to those held for farm land reclamation.

The structure of roads was determined to be sediment roads without gravel. Sections that were topographically at a low level or that would become main roads of villages in the future were laid with locally procured gravel using provided tractor shovels and dump trucks.

The surface of the roads was given a semicylindrical finish for water runoff using 6-ton bulldozers. Farmers welcomed this design with enthusiasm, saying that "With this, we can travel freely even during the rainy season, and can make our houses beautiful (became able to carry heavy materials)." The extension of the rural road infrastructure is shown in Table 3-6.

Table 3 - 6 Rural Road Development Status

	Ranometo	Palanga	Kiaca	Lapulu	Lalobao	Laeya	Sabulakoa	Onewila
Rural road development	3.76km	5.54km	9.58km	5.5km	3.5km	4.2km	7.0km	3.5km

Reservoirs

Reservoirs were built as irrigation facilities for the dry season. Their specifications are shown in Table 3 - 7.

Table 3 - 7 Intake on Weir Creation Status

	Ranometo	Palanga	Kiaca	Lapulu	Lalobao	Sabulakoa
No. of reservoirs	4 locations	1 location	3 locations	1 location	1 location	1 location
Pondage (m^3)	500~2,000	500	6,000	25,000	15,000	15,000
Weir length (m)	1 location 15m	15m	3 locations 150m	400m	400m	3.00
Newly built/renovated	Newly built	Newly built	1 newly built, 2 renovated	Renovated	Renovated	Renovated

Road crossing culverts

Directly managed culvert construction was performed using plain concrete pipes (ϕ 400 m, L = 1.0 m) commercially available in Kendari City. These plain concrete pipes, which were strengthened by full surrounding place concrete, were a bargain compared to conventional culverts (box culverts). Locally, culvert cylinders are called "gorong-gorong."

The numbers of road crossing culverts installed are listed in Table 3 - 8.

Table 3 - 8 Status of Directly Managed Road Crossing Culverts Installation

	Ranometo	Palanga	Lapulu	Lalobao	Sabulakoa	Laeya
Plain concrete pipe	ø 400mm L = 5.0m 2 locations	ø 400mm L = 5.0m 4 locations	ø 400mm L = 5~9m 3 locations	ø 400mm L = 5~9m 6 locations	ø 400mm L = 5.0m 1 location	ø 400mm L = 5.0m 1 location
Box culvert		1.0×0.85m L = 5m 1 location				

Rural bridges (Rural bridges constructed by farmers' groups)

The project supplies part of the materials needed for these constructions, and farmers themselves perform the work under the guidance of experts and counterparts. The log bridges traditionally made by farmers simply consisted of logs spanning a river and were prone to be washed away by floods, or mudslides in the part corresponding to the abutment caused them to collapse. In this project, instead of an abutment, four logs with a diameter of 20 cm and a length of 3.0 m were driven into the soil and topped with cushioning material. Then six bridge beams were positioned over the cushion part.

Moreover, taking into consideration the fact that wood bridges are often washed away during floods, experts for the mechanical control of posts and caps implemented various designs such as fastening using metal fittings, and farmers have now learned techniques that will enable them to build lasting bridges on their own.

Excavation for irrigation canals (construction done by farmers' groups)

Following the completion of irrigation works including intake weirs, diversion structures, and drops, farmers' groups implemented excavation work for irrigation canals. 25% to 35% of the labor expenses provided for this work is put in a stock fund to pay for future maintenance cost of facilities and group activities. With regard to the implementation of construction work, district leaders, village chiefs, extension workers, and representatives of farmers' groups get together in briefing sessions that cover work aims and contents, procedures, and reserves for part of the costs (labor costs). Directions for the work locations and assignments are also covered at these briefing sessions. Once all the members have given their approval, a contract is signed and the work is implemented.

The extension and construction cost of irrigation canals for each village, and the ratio allocated to a stock fund, are shown in Table 3 - 9.

Table 3 - 9 Irrigation Canal Extension, Construction Cost, and Stock Fund Ratio for Each Village

Village	Irrigation canal extension (m)	Construction cost (Rp)	Reserve fund (Rp)	No. of groups
Ranometo	3 canals 1,840	12,946	25% 3,225	9
Palanga	1 canals 1,176	4,883	25% 1,215	10
Kiaca	2 canals 1,910	8,086	25% 2,419	11
Lapulu	1 canals 1,595	6,725	25% 2,345	8
Lalobao	2 canals 1,360	6,283	25% 2,193	5
Sabulakoa	1 canals 2,725	12,191	25% 3,163	12
Onewila	2 canals 2,833	4,133	25% 1,032	7
Total	12 canals 13,439	55,243	15,592	62

(Unit: Rp1,000)

Construction of irrigation facilities

The work is done as contract work under the supervision of counterparts.

ii) Results and impact of activities

Prior to the commencement of construction work, local briefing sessions were held, mainly by counterparts, for local persons concerned (village chiefs, extension workers, core farmers, farmers' group representatives), and work implementation plans were drafted. The use

of this method, whereby farmers get to participate from the planning stage, is drawing attention in the area of public works in Indonesia.

The factors in judging the merits of this approach for paddy fields reclamation were the operation skills of the operators selected by villagers and the fact that the local level of reclamation work technology would be greatly boosted. As one of the quality control measures, surveys of completed works were performed using plane tables. Counterparts quickly acquired measurement techniques, and the adoption of this methodology proved to be an efficient quality control choice. In particular、control of completed works using photographs was a novel approach, whose necessity counterparts understood following suitable briefing.

With regard to directly managed work, local briefing sessions were held at each village. As a result, counterparts have a good understanding of the importance of the construction procedure, from stumpingt and surface soil removal to land grading. With respect to rural roads, to ensure that the roads to be built would be of use for everyday life, the opinions of farmers were surveyed on various occasions, and the roads constructed based on these survey results. To ensure that reservoirs would serve water resources for irrigation much needed during the dry season, their locations were carefully selected based on surveys.

With regard to works executed by farmers' groups, design surveys were performed, mainly by counterparts. With regard to funds used for paying the farmers' labor, 25% to 35% were allocated to stock funds to provide for future facilities maintenance costs and farmers' activities.

The construction of irrigation facilities and rural bridges was done on a contract basis, and counterparts were trained in construction supervision techniques in the process.

Regarding reclamation of alang-alang grasslands

The surface soil of alang-alang grasslands was turned over using disk plows. It has been established through this project that by passing the disk plows twice crosswise, alang-alang grass can be kept from growing again for a year and a half. The fact that alang-alang grass can be removed through the use of heavy machinery without using herbicide deserves special mention as a technology applicable to the region.

iii) Future issues related to agricultural infrastructure

Counterparts have become able to draft implementation plans and supervise constructions, but further technological transfers are required for integrated construction supervision ranging from construction implementation planning to construction cost estimates, the supervision of work using

heavy equipment, and construction supervision. With regard to quality control for concrete as related to agricultural infrastructure and construction supervision technology related to rolled compaction for rural road construction, despite the acquaintance with basic technology, further transfers of locally applicable technologies are needed.

The participatory approach and alang-alang weeding techniques developed for this project can be extended to other regions with the same potential for development, and their diffusion in future with the cooperation of related organizations including farmers' organizations, the Ministry of Public Works, and the Provincial Government, is necessary.

b) Development of agricultural and rural infrastructure

i) Contents of activities

Community wells were built in 36 locations on a directly managed basis by farmers' groups under the supervision of counterparts. Moreover, construction locations for the agricultural and rural infrastructure were selected based on surveys of concerned parties in villages and land owners. In total, 7 rice mills, 7 drying facilities, 2 livestock markets, 4 demonstration fattening yards, 14 extension worker office/farmer's meeting places, and 6 seed storage facilities were built.

1) Construction of community wells: Work by farmers' groups

- Selection of facility locations

  The selection of locations for facilities was done based on input from persons familiar with local conditions, including village chiefs and extension workers.

- Structure of community wells

  Based on data regarding the underground water level, the depth of wells was set at 5 m. Commercially available plain concrete tubes 80 cm in diameter and 50 cm long were used for the well frame, and the community wells were built to be 5 m below ground and 1 m above ground.

- Construction

  The concrete tubes, cement, aggregate etc., required for the construction of community wells were provided by the project side. Farmers' groups contributed only labor. The construction costs were calculated based on the estimate standards used by the Provincial Public Works Office. Furthermore, as the allocation of labor costs by farmers' group could not be done due to the small number of construction locations, no stock funds based on construction costs were created.

Table 3 - 10 Community Wells Construction Statistics

(Unit: Rp1,000)

Village	No. of locations	Well depth (m)	Construction costs		
			Labor cost	Materials cost	Total
Ranometo	4	20m (4×5)	1,100	2,056	3,156
Palanga	5	25m (5×5)	2,048	2,975	5,023
Kiaca	6	30m (5×6)	1,596	4,019	5,615
Lapulu	5	25m (5×5)	1,200	1,520	2,720
Lalobao	3	25m (5×5)	1,186	4,024	5,210
Laeya	5		1,591	4,819	6,410
Sabulakoa	4		1,737	3,697	5,434
Onewila	4		1,813	4,456	6,269
Total	36		12,271	27,566	39,837

ii) Results and impact of activities

The community wells built as agricultural and rural facilities have alleviated water drawing work for the women at the beneficiary villages; this has given them more time to work their vegetable plots, start raising poultry, and has thus greatly contributed to raising the living standards of villagers. The strong demand for rice mills and drying facilities meant that these facilities started being used immediately following their completion, while extension worker offices combined with farmers' meeting places are now widely used to host village events and core training.

1.3. Farming Plan

(1) Establishment of suitable technological level

The technology in question is production technology for enabling the switch to more valuable products for a fixed quantity of input materials. Contributing factors include whether to what extent the product is valued, the purse for securing the input materials required for production, and management skills.

Suitable technology for agriculture is created according to the requirements for the particular country it is to be applied to. However, in developing countries, the necessity of creating such technology based on the market and distribution scale, social and economic conditions, intellectual capabilities of farmers with regard to agriculture, is often not recognized. As farmers see it, the existing technologies are suitable.

In such a rural society, the achievement of a suitable technological level for agriculture requires an awareness of current conditions, as well as an understanding of the potential for agricultural development. Currently, technological reforms for agriculture are steadily making their way into farming villages. The harvest of rice through the custom of ani-ani (harvesting by women

and children) has now been replaced in practically all villages by reaping with sickles, which is more efficient. Furthermore, for threshing, farmers make themselves foot threshers, and some have begun renting power threshers (the Gotong Royong custom of Java is disappearing). These phenomena are attributed to social changes as young farmers are flowing to urban areas from Indonesia's outlying island areas, causing shortages of agricultural workers. However, the majority of farmers hope to escape from their poverty by increasing their agricultural income through the expansion of their farm lands. The reason that this project plays a large role in the expectations of local farmers is based on the above. However, despite these expectations, the economic and technological level of the local agriculture still remains low, and raising it will take considerable time and effort. Therefore, the suitable technological level aimed for in this project has been set so that it can be achieved by farmers or farmer's groups if they make some effort. The following goals were set once some measure of consensus was achieved.

The first goal is to replace human labor with mechanical power for areas that cannot be improved through human power alone. For example, plowing through human power takes a long time, and makes the effective utilization of land, deep plowing, and makes the application of organic fertilizer difficult. The prevention of disease and vermin also requires sprayers. Moreover, the quality of products rapidly deteriorates unless post-harvest treatment is performed promptly. Improvements in these areas make the use of equipment essential, and thus the equipment to be used must be within the means of farmers.

The second goal is to enable improvements in agricultural technology suitable to the local area using the above-mentioned mechanical power.

(2) Agricultural improvement goals

a) Improvement of land utilization rate

The average land surface per farm in the project district is about 2 ha, and is to be expanded through the development of new land. Therefore, since accurate cultivation is impossible through currently available labor, the introduction of two-wheel tractors is planned to shorten the work period and raise the land utilization rate.

b) Improvement of cultivation techniques

1) Soil improvement through deep plowing using two-wheel tractors and application of organic fertilizer, and fertile soil cultivation using green manure.

2) In a specific area, interrupt the cultivation of paddy for about one month for disease and vermin control purposes, forecast the breakout of vermin during the cultivation

cycle, and apply pesticide over large areas on a timely basis.

3) Create groups assigned to specific canals for paddy field, and perform water management based on the current growth stage using adequate rotation.

4) To prevent erosion along upland, establish adequate collecting channels while implementing measures to prevent denudation to eliminate surface runoff.

5) Perform soil surveys and devise appropriate measures.

6) To increase the added value of crops, have farmers perform processing within the range of their capabilities.

(3) Farming mode and cropping plan

The farming mode for the project district is defined as paddy field, upland, and estate crops on farm land provided with water facilities. Field zones with poor water availability are to be used for upland and estate crops, and estate crops are to be introduced in single-crop paddy field zones. The plan seeks to equalize labor and spread out risk from droughts and vermin through this compound cropping plan.

According to data on the average monthly rainfall over the last 10 years collected at the Kendari Airport, the rainy season starts in December and lasts until the end of June, and although there are large annual fluctuations, the dry season usually starts from July, and the amount of rainfall falls to an extremely low level from August to October. In 1982, rainfall from June to December totaled only 10 mm.

As can be seen from this rainfall distribution, cropping on farm land without irrigation is subject to extremely severe conditions during the dry season, with the danger of droughts, and the selection of drought-resistant crops is important.

The paddy field within the project district are provided with, although incomplete, irrigation facilities, but there is a possibility that water could not be drawn due to lowering of the water level during the dry season. However, the development of the irrigation facilities would enable up to three crops per year on paddy field. Two crops are planned for paddy field, as well as soybeans and vegetables. Moreover, green manure crops could be grown in paddy field that have low soil fertility.

For upland cropping, upland rice, soybeans, corn, peanuts will be the main crops, and cassavas may other besuitable crops.

Many farmers wish to cultivate cashews as their estate crop, with cacao being the next

most popular crop.

(4) Cultivation technology system

a) Rice cropping technology

1) Tillage and land preparation

Following completion of the preceding crop, the rice straw is sprinkled over the field and then the field is plowed using a two-wheel tractor. Then the field is flooded for rice planting, and then harrowed and leveled.

2) Multiple planting

A wet raised nursery bed is prepared, and seedlings between 20 to 25 days old (5 to 6 leaves) are used. Regular planting (by hand) is used as the transplantation method.

3) Fertilization

Fertilization of the nursery bed is done sparingly in order to prevent weak seedlings.

This fertilization is performed in three stages: at multiple planting, the tillering stage, and the panicle formation stage.

Table 3 - 11 Standard of Fertilization

	Urea	Dense phosphate	Kalium
Nursery bed	10~15g/m²	10~15g/m²	
Paddy	150 to 200 kg/h At multiple planting: 50 kg 21 days after multiple planting : 50 to 60 kg 40 days after multiple planting : 50 to 60 kg	150 to 200 kg/h Application of whole amount at multiple planting	50 to 75 kg/ha 21 days after multiple planting : 25 kg 40 days after multiple planting : 25 kg

4) Disease and insect control

Pesticide is sprayed using mist blowers when an outbreak is predicted or during the initial stage of an outbreak. Furthermore, when an outbreak is predicted over a wide area, joint spraying is organized by farmers' organizations.

5) Reaping

Farmers' organizations perform joint reaping using sickles on a sequential basis, and threshing using power threshers.

6) Drying

The threshed unhusked rice is sun-dried at communal drying facilities. During the rainy season, it is necessary to devise a cover formed of a vinyl film to protect the unhusked rice from the rain.

7) Sorting

Sorting is done insofar as possible using winnows.

b) Soybeans

1) Plowing and grading

In the case of paddy field, the area to be seeded is simply plowed. In the case of upland, plowing is done while applying organic fertilizer using two-wheel tractors, and then the fields are harrowed and leveled. A soil survey is also conducted during which the pH level and effective phosphoric acid level are checked. The acidity level is then adjusted and more phosphoric acid is added as required.

2) Seeding

50 kg/ha of controlled and stored seeds are seeded.

3) Fertilization

75 to 150 kg/ha of heavy phosphate is applied during plowing, and urea is also administered as required.

4) Weeding

Weeding is done at an early stage insofar as possible. The second weeding is done at the stage when soybean has appeared.

5) Disease and insect control

Pesticide is applied two or three times for vermin and disease control, including tabacco cutworm, 28-spotted ladybeetle, leaf beetle, soybean stem miner and disease of rust .

6) Harvesting

Harvesting is done at the suitable time by digging up or reaping with sickles. Following reaping, the crop is sun-dried lined up on the farm land or bundled.

7) Threshing

The crop is then threshed using power threshers, and sorted.

(5) Introduction plan of farm equipment

On a wide-area village level, the introduction of efficient and effective farm equipment is required, along with the establishment of agricultural production techniques adapted to local conditions. These techniques are to be transferred to and disseminated among end-user farmers, and are to be used with the farm equipment to support the activities of farmers' organizations.

The farm equipment introduction plan, while being based on the current technological level of farmers, should be aimed one step higher, and comprise farm equipment suited for this aim. Furthermore, if farmers evidence efforts to help themselves, suitable measures are to be adopted.

Based on the fact that this farm equipment is equipment required for the establishment of farming techniques for end-user farmers' organizations and the equipment management and operations training they administer, the equipment to be selected should basically be procurable and repairable locally, except for special equipment.

The introduction of farming equipment is to follow the lines of programs to develop food crop cultivation along with promoting the achievement of the technical aims of the Bimas Plan promoted by the government.

a) Liberation from heavy labor

Almost all farmers in the project district are cultivators, and there are no farmers without land (i.e. agricultural workers). Therefore, farmers engage in heavy labor on a daily basis using mainly manpower on their own land (1 to 2 ha). The current land utilization rate is high, with 2 to 3 crops each year, but if farmers could expand the scale of their farming as they wished, it is clear that heavy labor would extend further to women and children. It is therefore necessary to raise the awareness of farmers regarding the necessity of using farm equipment to alleviate the farming workload.

b) Improvement of cultivation techniques

The plowing of paddy field is done using mainly manpower, and in some parts animal power is used. The leaders of technologically advanced villages wish to use two-wheel tractors for plowing. Teaching farmers about cultivation technique improvements that could not be achieved with traditional farming implements is expected to have a significant impact on traditional agriculture.

c) Introduction of disease and insect control

Disease and insect control equipment is limited to two or three hand sprayers per village. Simultaneous pest control through the unification of cropping seasons in order to rationalize water management is required, and pest control equipment to be used in simultaneous pest control done by groups is needed (Bimas Plan).

d) Raising efficiency of post-harvest work

The efficient performance of post-harvest work depends in large part on improving the quality of products, and it is necessary to make farmers aware of the need to raise the ratio of marketable products and promote sales of high-quality products. Facilities and equipment are required to achieve this (Bimas Plan).

e) Treatment and processing of products

The farmers in the project district directly sell their harvested products. However, the fact that they can obtain a significantly higher selling price by processing even a little their products in order to give them added value is known. Cashew nuts are a typical example. By removing the hard shells of cashew nuts, farmers can sell them for more than twice their original price. An another example is sago coconut powder. Thus it is necessary to provide farmers' organizations with the equipment required to perform such processing and to make farmers aware that such equipment can help them raise their farming income.

f) Introduction of two-wheel tractors (hand tractors)

The introduction of hand tractors to farmers who are not acquainted with farming equipment is considered as an important technical innovation. Such introduction is to be done based on the following reasons as a means of raising and developing the basic technical level of Indonesian farmers.

1) Raise the land utilization rate by increasing the efficiency of plowing for each type of crop and reducing the work time (Bimas Plan).
2) Enable deep plowing, which could not be done by hand (Bimas Plan).
3) Enable the incorporation of organic fertilizer such as rice straw through the introduction of equipment.
4) Raise the quality of plowing and achieve more uniform crop quality.
5) Free farmers from the labor of plowing, and have them devote the excess time thus generated to the cultivation and management of other crops.

6) Along with having a big impact on farmers, this will motivate young people toward farming.

7) Have the farmers acquire administrative and technical know-how of power farming.

g) Maintenance and management of farming equipment

Farming equipment provided to farmers' organizations shall be loaned to farmers principally by each village's extension workers, who shall also see to its correct maintenance and management, while educating farmers about administering a reserve fund for purchasing new equipment in the future and making them aware that this equipment is the joint property of all villagers.

h) Bimas Plan (Mass guidance for self-sufficiency in foodstuffs)

Applied technique package for SUPRA-INSUS

1) Use of qualified elite seeds

2) Use of optimum fertilizer for soil type

3) Rotation of varieties and unification of varieties among farmers' groups

4) Creation of cropping pattern to raise utilization rate of farm land (rice-secondary crop-rice), achievement of dense planting of paddy field, and unification cropping and harvesting periods

5) Comprehensive control of disease and insect damage

6) Full use of plowing (at least two plowings and one puddling, plowing depth of 15 to 25 cm)

7) Implementation of effective water management

8) Full implementation of cultivation management (transplantation, weed control, water level of farm land)

9) Appropriate use of growth hormones

10) Improvement of post-harvest work (purchase of 20 sickles and drying equipment per farmers' group using credit)

i) Promotion of use of farming equipment to raise farm land productivity through MOA's food crop farming development plan

1) The promotion of the use of farming equipment aims to support farm management for farmers or farmers' groups by supporting improvements in labor productivity,

land productivity and management productivity, the increase and equalization of income, the increase of work opportunities, the reduction of production costs, the work load of farmers, and environmental conservation.

2) The aims of promoting the use of farming equipment nationwide are to quicken the expansion and improvement of the food crop production increase program.

- Increase of cropping area / improvement of concentration
- Raising productivity
- Improvement of product quality and minimization of losses

3) The farming equipment that is promoted must satisfy the following conditions.

- Simple to create, use, and manage
- Efficient and effective
- National production (in Indonesia) and assembly must be possible
- Must use low-cost materials in abundant supply

4) The promotion of farming equipment is to be done through the following initiatives.

- Possession by farmers of simple and low-cost farming equipment (accessible to and purchased by farmers)
- Use of farmer or lease service company credit, which requires cooperation among financial institutions, plants, distributors, farmers/companies. Plants and distributors are responsible for providing repair shops in central areas subject to promotion of parts and farming equipment.
- Promotion of rental/lease system by farming equipment service companies

1.4. Plan for guidance on farming techniques

An important measure for the dissemination of techniques is guidance on agricultural techniques through experiment and demonstration farms.

This project is geared principally to farmers' groups as the end users of techniques, and emphasizes the role of experiment and demonstration farms. It aims to strengthen the abilities of farmers, boost joint work among farmers, and to create a ripple effect for farming techniques.

According to a survey of existing conditions, farmers who have newly migrated to the project district wish to farm, but lack the resources or know-how, and local farmers have an extremely low technological level that centers principally on shifting cultivation.

Accordingly, the aim of experiment and demonstration farms is to stimulate cooperation in the direction of promoting progress in farming techniques for the project district (technologies that represent gradual improvements suitable for the district), introducing to some extent farming equipment, and transferring technology for their management, operation, and dissemination.

Persons eligible for technological transfers are local extension workers and key farmers, with the extension workers providing guidance to farmers' groups. The main experiment and demonstration farm is in Ranometo village, and the secondary demonstration and training farm is in Palangga village.

(1) Ranometo experiment and demonstration farm

a) Location of farm

The Ranometo experiment and demonstration farm is located 15 km from the center of Kendari City on the way to Kendari Airport. This location was selected on the basis of convenient access, as it receives visitors on a daily basis, and this fact is probably an important factor in its success. Thus, the Ranometo facilities plays a central role as an experiment and demonstration farm.

b) Experiment and demonstration contents

i) Experiment farm

An experiment farm compares conventional and new agricultural methods that have been established, but that have not been applied yet to the region, or it studies newly improved techniques and attempts to create new products, and analyzes the results of experiments (verification of locally applied techniques).

1) Experiments to adapt policy directions and technological conditions, in close coordination with local PPS (technical farming experts)
2) Testing using locally applied techniques and manuring practice guidance
3) Experimental cultivation related to agricultural technique improvements
4) Experimental cultivation gathering data related to improvement techniques
5) Testing of improvement methods for agricultural techniques using farming equipment
6) Testing of farming equipment that can be introduced by farmers both in terms of technology and cost

ii) Experiment and training farms

To promote and propagate already established techniques, they are compared to the cultivation methods currently employed in the region, their results are exhibited, and then the techniques are propagated.

JICA experts perform training on farms (Guidance on estate crops is provided by Indonesian technical officials), while providing guidance about basic techniques and training methods to their Indonesian counterparts.

1) Demonstration exhibits about work for which farming equipment can be used are organized in addition to exhibiting techniques established on experimental farms and improved manuring practices.

2) Training about techniques that should be disseminated (techniques that have been established through experimentation) and about the use of farming equipment is provided to extension workers and key farmers.

3) Have groups design and manage cultivation plans for cultivation using new techniques for crops, etc.

c) Experiment and demonstration crops

Experimentation and demonstrations are performed for each of paddy crops, upland crops, and estate crops, at exhibit centers for the region's advanced farming techniques. Moreover, visitors are made aware of the improvement in the technological level of farmers of the region using the proper farming equipment.

(2) Palangga demonstration and training farm

a) Location of farm

The Palangga experiment and demonstration farm is centrally located in a pilot village area (5 villages). The region has a large number of settlers, giving the farm a high demonstration effectiveness.

b) Demonstration and training farm

Extension workers and key farmers who have received training at the Ranometo experiment and demonstration farm verify themselves the techniques they have learned. The wide participation of the region's key farmers is invited, who receive training under the guidance of extension workers. JICA experts provide technical advice and provide the materials and equipment required for training.

c) Aims of experiment and demonstration farm

1) Give technical training to key farmers of a broad area.

2) Provide concrete experience in new techniques and problem solving.

3) Provide experience through demonstration fields based on farm expense details and other basic data.

4) Provide materials for public relations including meetings, newspapers, TV and radio broadcasts, etc.

d) Demonstration and training crops

Demonstration and training is performed separately for paddy crops, upland crops, and estate crops.

(3) Demonstration fields run by farmers' associations of each village

Related farmers gain experience by performing plowing themselves, in units of farmers' groups, according to the main crops of each village. As cultivation is performed mainly by key farmers under the guidance of extension workers, and as new techniques are implemented at farmer level, the propagation of farming techniques is predicted. The required materials and equipment are provided. The demonstration fields that are set up can be paddy field, upland fields (secondary crops), or estate crops, as required.

The aims of demonstration fields are as follows.

1) To ensure mastery of each work stage while verifying the understanding of related farmers.

2) To give farmers experience in comparing themselves the progress of production and yields.

3) To have farmers confirm and be persuaded of the value of improved techniques without having to try to convince them, through their fellow farmers.

4) To increase the possibility of introducing techniques by deepening the understanding of participants.

5) When new farming equipment is introduced, perform sufficient training regarding its operation and safety.

6) Perform training regarding the operation and maintenance of farming equipment, in units of farmers' groups.

(4) Activities and the results

a) Improvement technology introduction experiment

i) Contents of activities

From the commencement of the project until now, technology transfers to counterparts have been performed for corn, soybean, peanuts, directly sown paddy field, transplanted paddy field, upland paddy field, and cashew nuts.

ii) Results and impact of activities

Although there is no detailed data about farming in the project district, technological transfers were made in parallel with the development of appropriate technologies for the area for merging with the basic technology. Recently, the importance of paddy field and upland paddy field as crops for this area has been rediscovered, something that represents an important development that will affect the region's future technological development. Through this project, it has been demonstrated that secondary crops can be grown during the dry season following rice cropping.

iii) Future issues related to improvement technology introduction experiment

The importance of enhancing transplantation technology for paddy field is now understood, but for the time being, what is required is the accumulation of techniques that counterparts can adequately introduce according to existing cultivation conditions.

To achieve balanced development of the region, it is important to make counterparts capable of providing guidance on upland paddy field to extension workers and farmers. Counterparts are currently preparing manuals for the various technologies, and until this work is completed, guidance by experts is considered to be necessary.

b) Demonstration and extension of farming techniques

i) Contents of activities

The implementation status for two villages for TSI is shown in Table 3 - 12.

Table 3 - 12 Demonstration and Diffusion Implementation Status (Ranometo Village/Palanga Village)

Ranometo	Directly sown paddy field	From February 1992
	Soybean	From July 1992
	Corn	From January 1992
	Peanuts	From May 1992
	Transplanted paddy field	From December 1994
Palanga	Directly sown paddy field	From August 1993
	Peanuts	From May 1994
	Transplanted paddy field	From December 1994

ii) Results and impact of activities

Demonstrations were conducted mainly for two beneficiary villages for TSI, and the feasibility of upland cropping following either paddy field rice cropping or upland rice cropping was established. The demonstration of the feasibility of upland cropping is extremely meaningful to agronomy and the local economy.

Although counterparts mastered techniques related to demonstration, they still lack sufficient training on how to relay this know-how to extension workers. Demonstration and experiment farms were selected from among farms belonging to village chiefs, and the ripple effect to groups of 20 to 30 farms was considerable.

iii) Future issues related to the demonstration and extension of farming techniques

Counterparts must be given concentrated guidance on how to do technological transfers to extension workers. Furthermore, although land development models were demonstrated among the project's various activities, there were instances of vacillation about beginning such cultivation, which indicates the necessity of at least a minimum of performing model demonstrations at the remaining other villages.

1.5. Maintenance of equipment and facilities

(1) Maintenance of equipment and facilities

Through this project, various equipment and facilities have been provided, both for the reclamation of agricultural land and for farming (See attached documents). In the eventuality of problems in equipment, etc., the absence of maintenance shops in each area would have represented a problem. To ensure the continuous availability of maintenance services, various MOA-related organizations and possible measures were studied, during the planning stage, but no concrete conclusions were reached. Therefore, mobile maintenance trucks were distributed throughout the project district that performed repairs as necessary, as a measure in the case of local equipment problems.

Moreover, as the result of talks between experts and counterparts, it was decided to recruit volunteers in each village and train them as drivers and maintenance workers.

In other words, it was decided that persons selected among the youths of each village participating in the project (2 drivers, 1 maintenance worker) would be trained and posted as drivers and maintenance worker.

However, in the case of heavy machinery for developing agricultural land, the structure of the equipment is complex, and it would have been impossible to adequately train maintenance workers during the project's cooperation period. Thus, training concentrated on farming equipment. Problems in heavy machinery were handled by experts and counterparts, who performed parts replacements, etc. Now manufacturers have maintenance staff posted permanently in Kendari city, and as a result, complex repairs can be referred to them. With regard to training for equipment maintenance, upon delivery of equipment, audiovisual equipment was used to show methods for daily inspection of equipment, lubrication checks for each part, parts replacement, and equipment operation, and following inspection of potential dangers in the workplace, actual work was started.

Moreover, as the result of guidance provided to counterparts by experts, counterparts are now able to direct maintenance of equipment in each village. Also, as part of the system that is being established, equipment ledgers and parts ledgers are being used. On the other hand, guidance regarding the inspection and repair of back hoe injection pump failures, exchange of hydraulic cylinder oil seals, repair of carrier rollers, replacement of bulldozer chain parts, cleaning of fuel pipe systems, oil replacement for caterpillar adjustment cylinders and other parts, electrical system of four-wheel tractors, hydraulic systems, and oil seal leaks, are required on a frequent basis.

In the future, procurement of parts for the maintenance of equipment at each village from the sales offices of manufacturers will be possible. An arrangement has also been made for ordering parts not in stock at local stores. Additionally, technicians on the manufacturers' side are now available for maintenance and providing guidance regarding repairs.

(2) Organization for the maintenance of equipment and facilities (current status, problems, and countermeasures)

As part of the agricultural facilities built in this project, rice mills have been established in each village except Laeya. Moreover, plows, threshers, irrigation pumps, sprayers, and other small farming equipment have been provided to villages.

Rice mills are operated by Farmers' Group Unions (FGUs) organized in each village, and the cooperation of extension workers has been enlisted for booking and other tasks. Comparing

facilities and equipment to farming equipment, there have been no major failures and accidents and their use is stable. However, rice mills in villages other than Ranometo and Lapulu are not yet used to process large quantities. Possible problems are that they are competing with private rice mills, their location, and small overall amounts of rice for the entire village, the enthusiasm of managers, lack of understanding on the part of farmers' groups, and so on. In particular, the balance after usage fees (10% payment in kind) remaining after subtractions for necessary costs are accumulated in stock funds and amortization funds.

The rice mill of Ranometo is operated by the KUD, but approximately 75% of gross earnings are accumulated in reserve funds and amortization funds. In the same way as for Lapulu, reserve funds are used for the development of the village's comprehensive farming operations, including financing the business of acting as a agent for rice sold to the government, and using rice bran and other farm by-products for poultry farming and stockbreeding.

Smoked charcoal is now produced using husk that is currently being amortized for use in improving acidic soil. By emulating the usage example set by Ranometo it should be fully possible to amortize and replace equipment as needed.

Until now, extension workers have been responsible for the management and operation of farming equipment in farming equipment usage associations.

Regardless of great efforts in equipment operation and maintenance departments, operation is still afflicted by numerous problems. One is that on average approximately 15% of equipment usage fees are not collected. One possible reason is that following plowing work, usage fees are not systematically collected. Another factor may be that extension workers, who are responsible for management, lack management skills.

As an improvement measure, the transfer of management responsibilities was decided on December 1996 at a conference of equipment usage related representatives. In many villages, FGUs have started being in charge of management, but it is probably preferable that organizations such as KUDs take over for the sake of long-term and stable operations. Already in Ranometo and Lapulu, KUDs are in charge of managing rice mills and are obtaining positive results.

The second problem is that the total plowing area failed to expand. According to usage statistics, even in Ranometo, which had the largest total plowing area, the average annual plowing area per plow was approximately 15.6 ha. Assuming plow usage over two seasons each year, the total plowing area per season per plow would be under 8 ha. In Sabulakoa, which has the smallest total arable land area, the average plowing area per plow per year is only approximately 1.5 ha.

The fact that an insufficient total paddy field area has been developed is another reason, but other factors include insufficient communications among farmers, extension workers and operators, as well as inadequate organizational management know-how. According to a survey of C/P for equipment, the line of balance for plowing equipment is 20 ha of plowing area per plow per year. How to raise the utilization rate of equipment up to this point is the issue at hand. In Japan, there is no such standard of 20 ha/year, but ideally if 100 ha are plowed over 5 years, it would be possible to replace the equipment. However, considering the efficiency of operators, paddy conditions, the performance of the equipment, and other conditions, this standard is probably fairly difficult to meet.

The fact that the farming equipment usage association of Ranometo managed to purchase an additional plow with its own funds deserves special mention. However, an examination of the overall situation shows this to be an exceptional case of success. Currently, considering that within villages individual farmers can rent a plow for approximately the same amount, it is not possible to raise the usage fee any further, and therefore more rationalization efforts are needed. Furthermore, as the total paddy area of villages has increased, studies regarding the appropriate size of equipment, its ease of use, and other factors, are probably required.

1.6. Participation of farmers in project

As a model project for regional development, this project aims for a broad range of technological transfers, from the creation of agricultural infrastructure facilities, maintenance of farming equipment and facilities, and the reinforcement of farmers' organizations, to life improvements. These technologies are to become firmly established at the counterpart, extension worker, and farmer levels, and their propagation is a major theme.

For these purposes, with regard to concrete methods for firmly establishing these technologies, the efficient use through effective methods of provided labor costs and farming equipment through the development of farming villages with model villages and farming activities is required. So is indicating concrete methods for managing constructions and funds and materials in order to reinforce farmers' organizations, and indicating the type of relationships with farmers in this project.

This project, by aiming to strengthen farmers' organizations, is expected to farmer participation in planning, construction, and farming guidance, and to deliver various beneficial effects as a result. Therefore, through farmers' groups, the scope of responsibilities of agricultural extension workers performing agricultural extension work could be somewhat exceeded.

While keeping agricultural concerns the main focus of the project, with regard to agricultural infrastructure and life improvement, it is an absolute necessity to have local experts throughout the duration of the project who can perform crossways coordination at the work site level among village office on the project side, extension centers at the district level, and related administrative organs, while maintaining close cooperation with extension workers.

Moreover, JICA experts who can provide guidance at each stage of farmer participation are also probably required. Farmer participation should not simply be used as a temporary mobilization expedient or for the fulfillment of temporary responsibilities. Instead, technical specialists on the Japanese side are required to perform coordination in order to make it easy for farmers' groups to make use of the various data input throughout the project.

The following three main skills are considered to be required to promote the participation of farmers.

1) Be able to talk with farmers in their villages.
2) Possess some technical specialization.
3) Pay attention to sexual and socio-cultural differences as related to agriculture.

At present, the majority of villages have some experience of building infrastructure, small-scale irrigation facilities, rural roads, bridges, POSIANDU, meeting places, and so on. However, in promoting farmer participation following the agricultural development plan of the Southeast Sulawesi Province, there are the following pitfalls, none of which can truthfully be called "farmer participation."

1) Ask farmers to approve blueprints written by project staff or experts "for residents," and go ahead with these plans as they are.
2) Offer farmers only simple tasks.
3) Consider increases in the number of users of administrative services and diffusion projects as farmer participation.
4) "Enthusiastic" cooperation on the part of village chiefs

In contrast to the above, farmers themselves consider that projects are their own, and it is therefore necessary to allow them to participate actively in projects. Moreover, it is also important to recognize the trial and error process farmers go through as a learning course and as part of their training. Organizations such as those listed below could participate in the implementation of this project.

(1) Village Social Activities Group (LKMD)

With regard to village development, the village office organization drafts implementation plans for the coming year and makes budget allocations for subsidies. The total annual budget is in the order of Rp2 million, and is used mostly to build rural roads, bridges, repair water intakes, or fund the construction of buildings such as meeting places.

(2) Water Users Association (P3A)

The Water Users Association performs various maintenance tasks such as repairing and cleaning canals for irrigation and repairing intake weirs, and is run in the same way as a committee by the chairperson of each farmers' group (Kelompok Tani).

In this project, the water users organizations were positioned as organizations for the implementation of works (excavation of canals, building of ancillary facilities). Therefore, the reinforcement of the activities of these water users associations and their education are considered necessary. These organizations perform the construction of irrigation facilities and small-scale bridges, and have as their organizational function responsibility for budget of LKMD.

(3) Rural Women's Association

The Family Welfare Organization (PKK), a resident women's group, has an annual budget of approximately Rp500,000, which is used for life improvements, welfare for poverty level farmers, and so forth. This activity organization, which is distributed at the village level (DESA) and at the hamlet level, is composed of village chiefs' wives and women leaders. On the other hand, MOA promotes the organization of women's chapters at each Kelompok Tani.

(4) Communal work (Gotong-royong and Swadaya)

One form of organized activity, communal work is organized by the village chief and consists in unremunerated joint work. Activities range from compulsory labor (labor service) involving all farmers delivered at the village's request and include the construction of irrigation canals, intake weirs, and rural roads, to mutual aid such as offering banquet funds for couples getting married, providing materials for building housing, and so on. In the case of civil works for land reclamation for paddy fields, labor service, the purchase of materials and labor service are repaid with a meal, an allocation from the provincial government budget, and a donation from the owner of the land.

1.7. *Other plans (Reinforcement of training for farmers' organizations)*

(1) Post-harvest (agricultural product processing organization)

Almost all agricultural products are shipped as they are to market following their harvest. However, by adding some processing prior to selling them, it is possible to give them added value, as well as make efficient use of women labor. However, such work requires some facilities and tools, and is therefore difficult to realize on an individual basis. Therefore, active involvement through joint work by farmers' organizations and the women's groups in farmers' groups is desirable.

In particular, the participation of rural women in production activities will not be limited to the traditional offering of labor, but is thought to hold potential in terms of setting in motion energies in rural society.

(2) Improvement of distribution structure for agricultural products (distribution system)

The greater portion of farmers' agricultural products are distributed through brokers. Brokers visit each farmer and negotiate prices separately with each, evaluating quality unfairly in an attempt to get the best, i.e. lowest, prices. Farmers on their side do not try to raise the quality of their products, and therefore their asking price remains unchanged. Rice, in particular, is used for personal consumption by farmers, and although the rest is sold at varying prices, this represents only a limited amount. However, soybeans and estate crops are the main cash crops of farmers, and therefore sales channels must be established for these products. As described earlier, village cooperative units, or Koporasi Unit Desa (KUD), are not very developed in the project district. This may be due to the lack of education of farmers regarding agricultural cooperatives and their mistrust of shared profits. However, these problems need to be overcome and cooperatives constituted by the farmers themselves must be developed based on the participation of farmers as the principal agents. This should consist in the following:

1) Develop organizations for advantageously selling in a dependable way the surplus agricultural products of farmers (who have extremely weak individual selling power), and perform joint purchasing of required farming equipment.
2) Secure agricultural brands and processing of agricultural products for farmers, and organize joint production in order to raise market prices of agricultural products.
3) By expanding social activities in which farmers cooperate through joint work and learn how to run things in an organized way, giving them the opportunity to experience a wide range of activities, the likelihood of their learning agricultural production and life improvement techniques is increased.

4) It is necessary to free small farmers from high-interest loans and money advances to be repaid in kind by having them take advantage of the benefits of agricultural cooperative financing.

5) Preparation of audiovisual educational materials (farmers' extension work organization)

The preparation of audiovisual educational materials and public relations activities equipment is almost entirely neglected. Extension and public relations activities are conducted using pictorial panels and pamphlets printed with a rudimentary printing press. It is necessary to prepare suitable material and equipment and use them to actively conduct public relations activities to the persons concerned and extension activities to farmers.

a) Support of extension activities and PR activities to farmers

The Indonesian Government has positioned this project as a model "Integrated Agricultural and Rural Development Project," and aims to spread this model widely across Indonesia. Although provinces in Indonesia are provided with Agricultural Information Centers, these centers do not have an information relay function. It is necessary to use these centers to create a series of records of the development process of agricultural projects through farmer participation and of the agricultural results thus achieved, by filming TV programs, editing tapes, creating cassette tapes, and so forth. In addition, new techniques that have been verified in experiment and demonstration farms, and cultivation techniques for various crops could be suitably recorded on film and be used for the propagation of new techniques. The preparation of the required material and equipment is a necessity for the above.

b) Preparation of audiovisual equipment for agricultural extension centers

Extension centers within the project district do not have audiovisual equipment, and extension activities are limited to the occasional use of charts. As a result, vast differences in the understanding level of farmers are suspected. Furthermore, since such extension activities are performed mostly at night, the number of participating farmers is limited.

Moreover, the greatest part of the project district does not have electricity, and farmers use pamphlets distributed by extension workers and transistor radios as their sources of information. While the literacy rate of farmers is improving, it is still low. Given this situation, it is necessary to improve the technical level of farmers through the use of videocassettes. Moreover, since meetings are held at night, entertainment programs should also be shown at this time, to ensure the transmission of agricultural techniques to the highest possible number of farmers.

Further, in order to encourage the social orientation of local women, providing VCRs and TVs in the meeting place of each village would be very useful, as they could be used by female extension workers to show videos on given topics such as life improvement, nutrition improvement etc., followed by discussions.

(3) Activites and the Results

a) Surveys of farmers' organizations

i) Contents of activities

Basic information regarding the state of land ownership in the project district, actual cultivation statistics, and farmers' organizations related to facilities were obtained through socioeconomic surveys. Additional data about farming systems and farmers' organizations was collected through comparative surveys with other areas where similar projects had been implemented.

ii) Results and impact of activities

Rural surveys were conducted for a total of eight villages from 1992 to 1994. The results of these surveys were compiled as basic agricultural data of the local societies, and proved to be highly useful for understanding conditions in the project district. In addition to these surveys, 10 types of similar surveys were conducted for other areas where similar projects were implemented. These areas where the provinces of South Sulawesi, Central Sulawesi, Kalimantan, Maluku, West Sumatra, East Java and Central Java, and the three districts of Southeast Sulawesi (Kolaka, Muna, and Buton).

By learning about various farming systems and different socioeconomic conditions, the project's activities achieved a deepening of relationships with farmers' organizations, and counterparts acquired knowledge and experience in socioeconomic survey techniques.

b) Organizational promotion and strengthening related to project participation

i) Contents of activities

Farmers were organized based on the state of existing farmers' groups, to ensure efficient leadership and guidance by extension workers and counterparts. The guidance provided through this organization is expected to result in the proper use of facilities built for common use and to the adequate use of valuable resources.

ii) Results and impact of activities

Until now, farmers have formed 67 farmers' groups, 23 women's groups, 14 youth groups, 7 farmers' group associations, and 4 Water users associations. These

organizations were provided the necessary equipment, materials, and farming equipment for the cultivation of paddy field, secondary crops, cashew nuts, and vegetables, as well as poultry farming.

During this project, a stock fund system was introduced based on the wages received by farmers for working in the construction of irrigation facilities and land reclamation. Moreover, through counterpart activities, the farmers' groups at each village are now attempting to form optimum organizations for the maintenance and organization of facilities.

However, the system developed at one village cannot necessarily be transferred as is to other villages. Therefore, counterpart activities must be continued at each respective village. As to extension workers, they play a central role in counseling farmers so that they can take prompt action when problems are found.

Counterparts learned methods for mobilizing farmers' groups and organizing autonomous management within farmers' groups. Farmers have also begun learning about methods to use facilities while maintaining them, as well as manners for cooperation between members. Activities to strengthen farmers' organizations started through this project are likely to have a large effect improving the living standard of farmers.

c) Support projects for organized activities

i) Contents of activities

In order to activate farmers' groups, small-scale activities for generating small incomes were organized. The required equipment and materials were provided, and the necessary technology was introduced to support activities promoting the possibilities of farmers' groups. Training within and outside the villages as well as survey trips were also organized to support these small-scale activities.

ii) Results and impact of activities

Some of the activities that are being implemented are the distribution of nursery stock, the cultivation of vegetable plots, the processing of cashew nuts, and poultry farming. These activities are conducted primarily by women's groups and youth groups. Moreover, besides these activities, support of water users associations activities was provided in the form of preparing cadastral maps for the Ranomeio village and organizing study tours to Bali, which has advanced water users associations. In order to inform people in regions other than the project district about the progress of farmers' activities and promote the organization of farmers, agricultural festivals were held several times. Through these activities, the people of other areas were able to observe the results yielded by the introduced technologies.

For the counterparts to enlist the attention and willingness of participants, it is necessary to create various activities. On the other hand, in order for farmers to raise their standard of living, they must and are learning working methods whereby they can achieve harmonious cooperation within their farmers' group.

iii) Future issues related to organized activity support projects

In order to spread and implement all activities to other areas, the technical tools must be translated and printed in Indonesian under the leadership of counterparts.