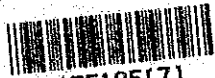


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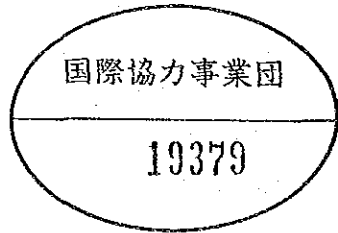


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THE REPUBLIC OF PARAGUAY
THE FEASIBILITY STUDY
ON
THE INTEGRATED RURAL INFRASTRUCTURE
IMPROVEMENT PROJECT
IN
LA COLMENA
MAIN REPORT

MAY 1989

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)



P R E F A C E

In response to a request from the Government of the Republic of Paraguay, the Japanese Government decided to conduct the Feasibility Study on the Integrated Rural Infrastructure Improvement Project in La Colmena and entrusted the survey to the Japan International Cooperation Agency(JICA).

JICA sent to Paraguay a survey team headed by Mr. Narao Takemura, Naigai Engineering Co., Ltd., at two stages, from July to at the beginning of October(Phase I) and from the end of October to December(Phase II), 1988.

The team exchanged views with the officials concerned of the Government of Paraguay and conducted a field survey in La Colmena area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the development of the Project and to the promotion of friendly relations between our two countries.

I wish to express my sincerest appreciation to the officials concerned of the Government of the Republic of Paraguay for their close cooperation extended to the team.

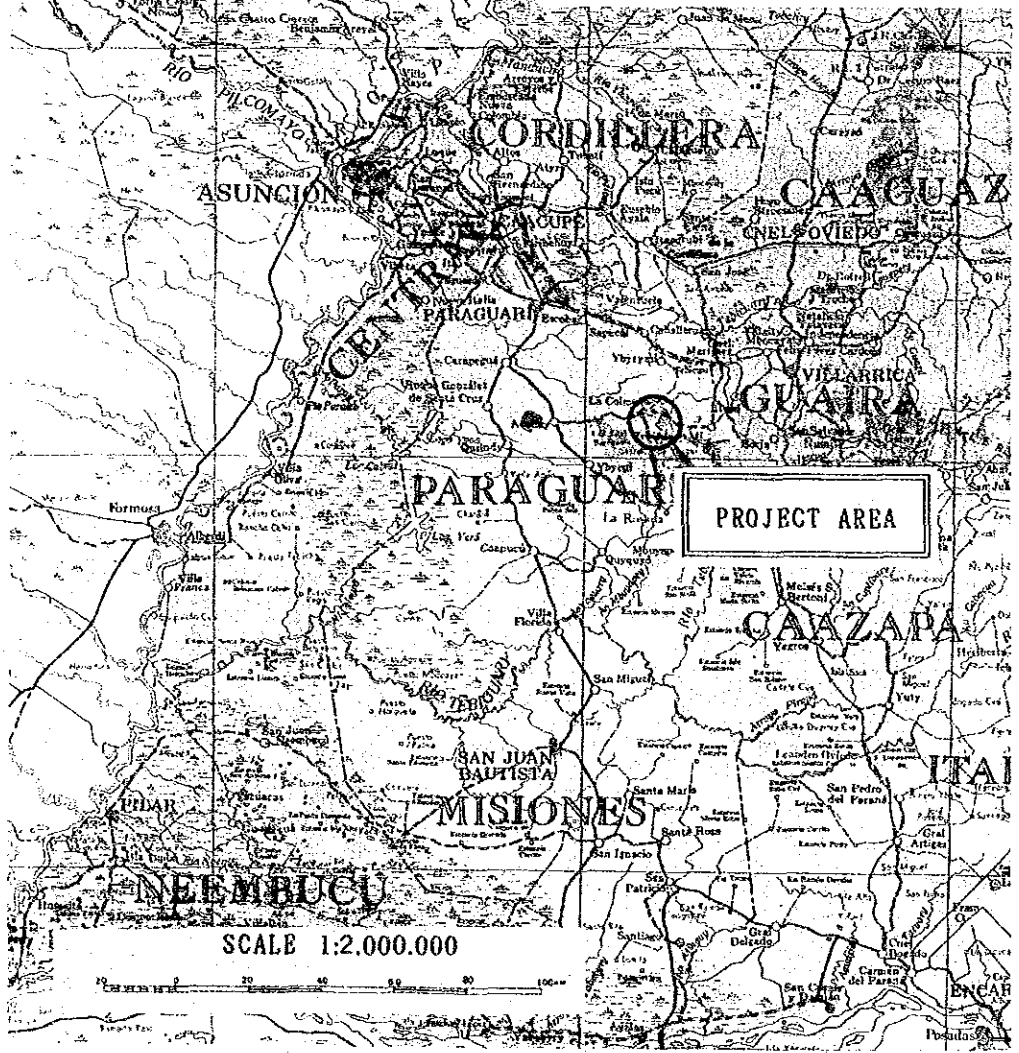
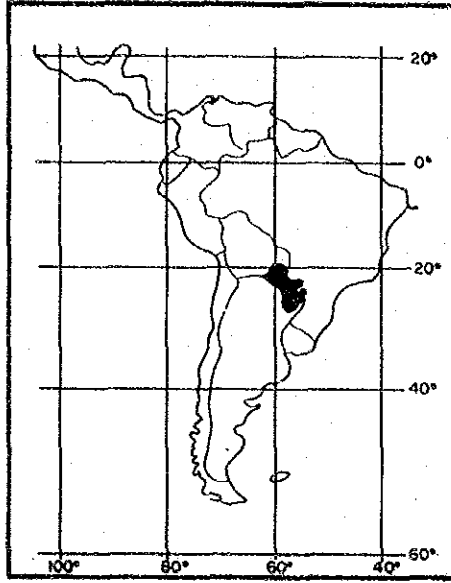
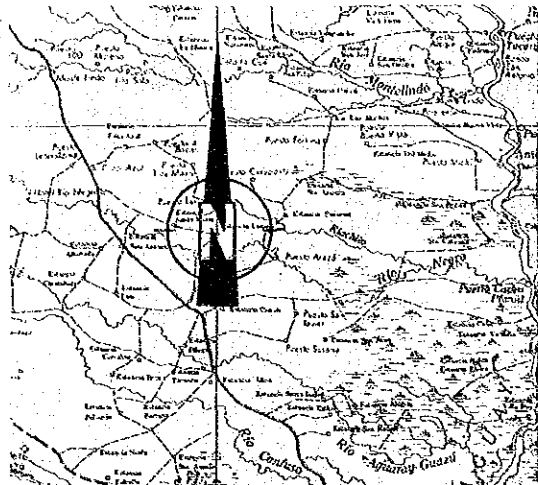
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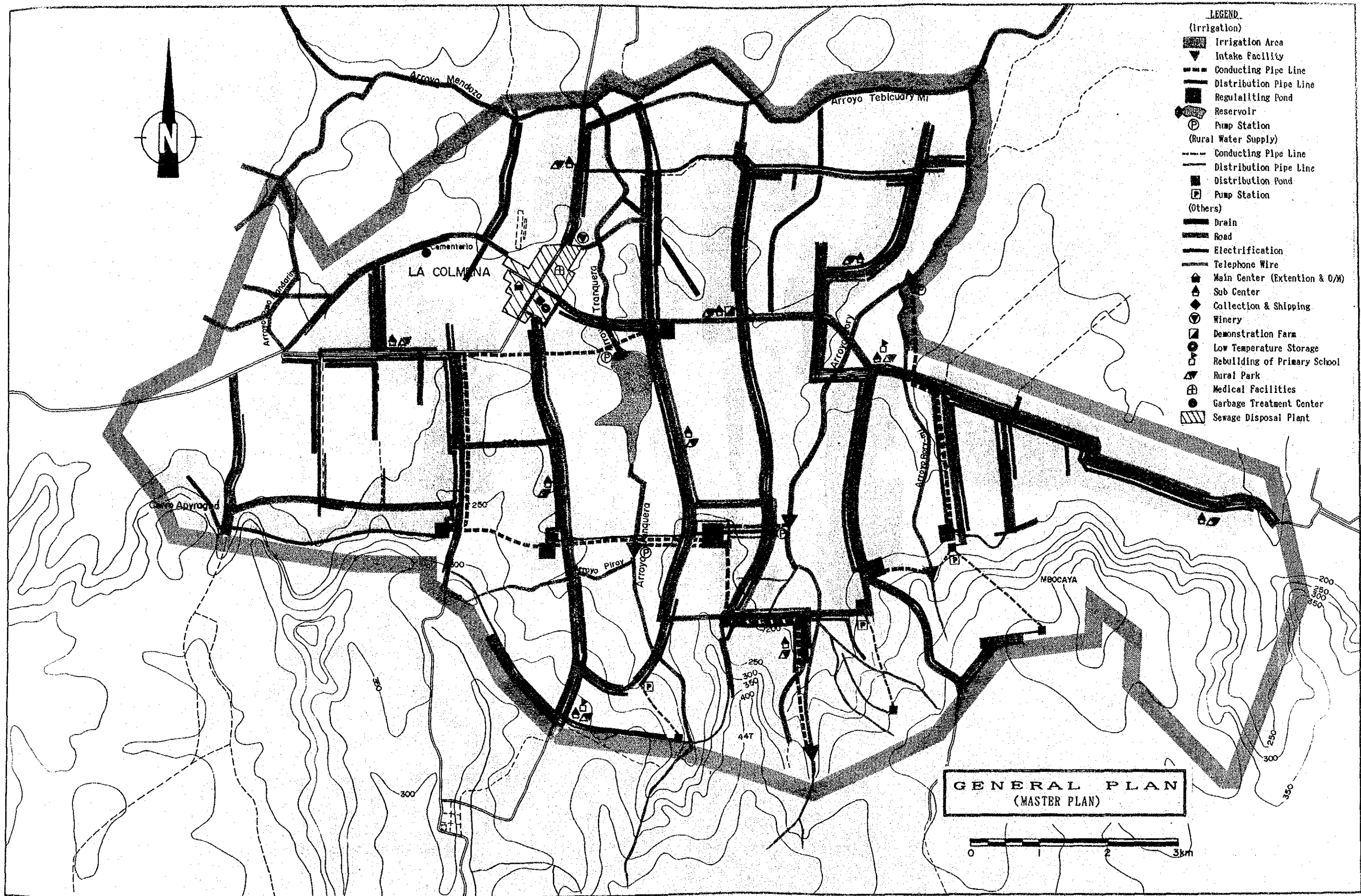

Kensuke YANAGITA

President

Japan International Cooperation Agency

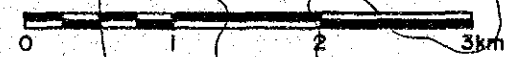
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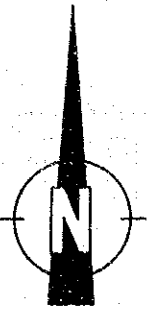
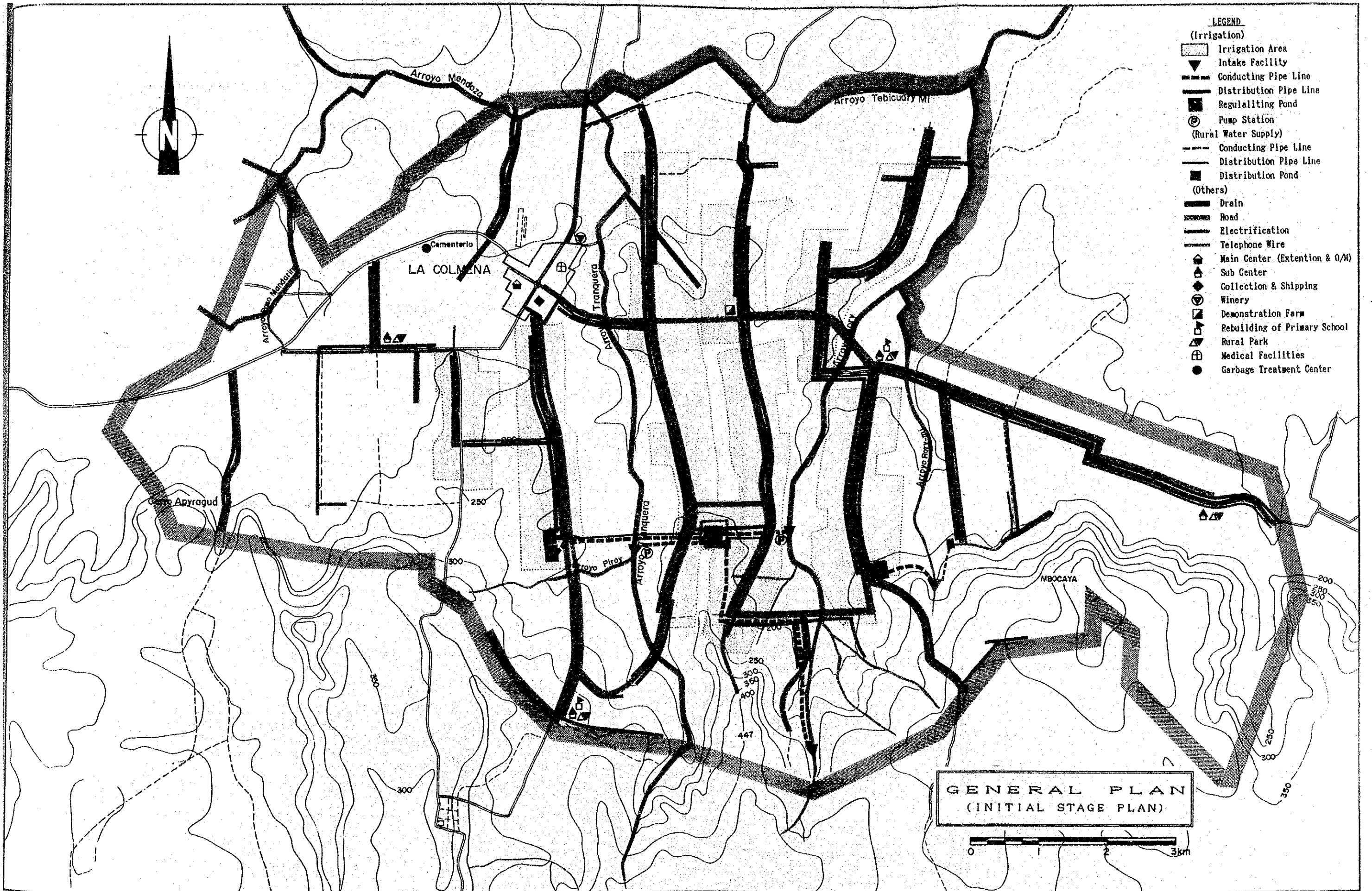




- LEGEND**
- (Irrigation)
- Irrigation Area
 - Intake Facility
 - Conducting Pipe Line
 - Distribution Pipe Line
 - Regulating Pond
 - Reservoir
 - Pump Station
- (Rural Water Supply)
- Conducting Pipe Line
 - Distribution Pipe Line
 - Distribution Pond
 - Pump Station
- (Others)
- Drain
 - Road
 - Electrification
 - Telephone Wire
 - Main Center (Extention & O/M)
 - Sub Center
 - Collection & Shipping
 - Winery
 - Demonstration Farm
 - Low Temperature Storage
 - Rebuilding of Primary School
 - Rural Park
 - Medical Facilities
 - Garbage Treatment Center
 - Sewage Disposal Plant

GENERAL PLAN
(MASTER PLAN)





Arroyo Mendoza

Arroyo Tebicuary Mi

Cementerio
LA COLMENA

Tranquera

Cerro Apyragud

Arroyo Piroy

Arroyo Inquera

Arroyo Rot...

MBOCAYA

250

300

350

300

250

300

350

400

447

200

200

250

300

350

250

300

350

The Republic of Paraguay

The Feasibility Study on The Integrated Rural Infrastructure Improvement Project in La Colmena

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ABBREVIATIONS

INSTITUTIONS AND ORGANIZATIONS

ABASTO	ASUNCION CENTRAL FOOD WHOLESALE MARKET
ANDE	NATIONAL ELECTRICITY ADMINISTRATION
ANTELCO	NATIONAL TELECOMMUNICATION ADMINISTRATION
APAL	PARAGUAYAN ALCOHOL ADMINISTRATION
AUCA	AGRICULTURAL CREDIT USERS ASSOCIATION
BCP	CENTRAL BANK OF PARAGUAY
BID	INTERNATIONAL DEVELOPMENT BANK
BNF	BANK OF NATIONAL FOMENTATION
CAH	HABILITATION AGRICULTURAL CREDIT
CRIA	AGRICULTURAL RESEARCH REGIONAL CENTER
IAN	NATIONAL AGRICULTURAL INSTITUTE
IBR	RURAL WELFARE INSTITUTE
MAG	MINISTRY OF AGRICULTURAL AND LIVESTOCK
ME y C	MINISTRY OF EDUCATION AND CULTURE
MIC	MINISTRY OF INDUSTRY AND COMMERCIAL
MOP y C	MINISTRY OF PUBLIC CONSTRUCTION AND COMMUNICATION
MSP y BS	MINISTRY OF WELFARE
SEAG	AGRICULTURE AND LIVESTOCK EXTENSION SERVICE

MONETARY UNIT

G	PARAGUAYAN GUARANI
US\$	UNITED STATES DOLLAR

ECONOMIC TERM

B/C	BENEFIT-COST RATIO
CIF	COST, INSURANCE AND FREIGHT
EIRR	ECONOMIC INTERNAL RATE OF RETURN
ENPV	ECONOMIC NET PRESENT VALUE
FIRR	FINANCIAL INTERVAL RATE OF RETURN
FOB	FREE ON BOARD

OTHERS

BOD	BIOCHEMICAL OXYGEN DEMAND
DO	DISSOLVED OXYGEN
EC	ELECTRIC CONDUCTIVITY
PH	HYDROGEN-ION CONCENTRATION
GL	GROUNDWATER LEVEL
MSL	MEAN SEA LEVEL
EL	ELEVATION ABOVE MEAN SEA LEVEL
Ao.	STREAM
mm	MILLIMETER
cm	CENTIMETER
m	METER
cu.m	CUBIC METER PER SECOND
MCM	MILLION CUBIC METER
cu. m/s	CUBIC METER PER SECOND
km	KILOMETER
sq. km	SQUARE KILOMETER
g	GRAM
kg	KILOGRAM
ton	METRIC TON
ha	HECTARE
C	DEGREE CENTIGRADE
mmho/cm	MILLIMHO PER CENTIMETER
HP	HORSEPOWER
ppm	PARTS PER MILLION

S U M M A R Y

S U M M A R Y

1 INTRODUCTION

1.1 Background of the Study

The Government of Paraguay requested the Government of Japan for a feasibility study on the Integrated Rural Infrastructure Improvement Project in La Colmena in July 1985. In response to this request, the Government of Japan, through the Japan International Cooperation Agency (JICA), sent a preliminary study team to Paraguay in January 1988. The Scope of Work for the Study was discussed and signed by and between both parties on February 2, 1988. Accordingly, it was decided to conduct the Study on the project in line with the Scope of Work. The field study was executed in two phases, during the period from July 26 to October 2, 1988 and November 1 to December 24, 1988. This report describes in detail the basic plan and priority project based on the results of the studies.

1.2 Objectives of the Study

The objectives of the Study is to establish a basic program for the Integrated Rural Infrastructure Improvement Project for a betterment of the fundamentals of agricultural production and living standards in La Colmena region in the Department of Paraguari.

1.3 Study Area

The Study Area is the administrative district in La Colmena which has about 11,000 ha in area.

1.4 Scope of the Study

The Studies will execute on the items of agricultural production and the living environments in La Colmena, then, formulate a comprehensive rural infrastructure improvement plan in the Area. Furthermore, a feasibility study is implemented for the selected projects in the said plan.

2 GENERAL FEATURES OF PARAGUAY

2.1 General

The country's land area is around 407,000 km². The Paraguay River, flowing through the central part of the country from north to

south, separates the country into two regions, the east and west. The population of Paraguay in 1987 was about 3.9 million, of which 97% was in the eastern region. Though the average annual growth rate of the population from 1974 to 1983 was 3.2%, the average growth rate for the last four years (1984-1987) has declined to 2.9%. The population of the metropolitan area centering around Asuncion, capital, is estimated at about 800,000. The major industry is agriculture and agro-industry related to the agricultural products. Agricultural production of Paraguay contributed 26% of the GDP in 1987 and employed 500,000 people or 40% of the employed population (1.23 million). Thus, agriculture plays an important role for the nation's socio-economy.

2.2 National Economy and Agriculture

The Gross Domestic Production Value (GDP) in the last five years (1982-1986) meant a minus or lower growth rate due to depression of the agricultural sector which is the key industry of the country. However, increase of the growth rate of the agricultural sector recorded 7% in 1987 compared with last year, and the growth rate of GDP was recorded at 4.3%. Furthermore, increase of the growth of GDP in 1988, is projected to reach 6% compared with preceding year. The basic economy appears well on the way toward recovery.

The main export goods of Paraguay are soybeans, cotton, beef cattle and their processed goods. In particular, soybeans and cotton are heavily exported, accounting for 60 to 70% of total exports. Production goods such as machinery and petroleum account for 40 to 50% of total imports.

The average annual consumer prices rose 22.5% in the last five years (1983-1987). Food is the major component of the consumer prices; food prices in 1987 rose by 42.3% over the preceding year. The rate of increase in wages has not kept up with the rate of increase in prices. The real income has declined. The minimum wage in June, 1988 was 119,350G/month.

The labor force in Paraguay was 1.23 million in 1987, equivalent to about 32% of the total population. In the five years from 1983 to 1987, the labor force increased at the rate of 2% per annum. The unemployment rate in 1987 is estimated at 8.7%.

2.3 Trend of Agricultural Production

In 1987 cultivated land accounted for about 3.99 million ha and

grassland for 19.9 million ha. The forests occupy 38% of the total area of Paraguay.

According to the 1981 agricultural census, the number of land holding farm households was around 2.41 million. The total land holding area was about 21.94 million ha. Small-scale farmers owning less than 20 ha accounted for about 80% of all farm households.

Main agricultural products in the country are cotton, soybeans, sugarcane, wheat, maize, mandioca and poroto. Cotton and soybeans are mainly produced for export. The rest are for domestic markets or self-consumption. Main agricultural products except poroto show a tendency to increase. In particular, the production of cotton and soybeans is increased markedly. In 1985 both cotton and soybeans recorded the highest production ever, of 469,000 tons and 1,172,000 tons respectively.

Livestock is mainly beef cattle which number around 6.66 million head (MAG, 1987). The total quantity of beef cattle sold is 6.8 ton, 66% for domestic consumption and the rest for export.

2.4 Demand of Principal Food

The amount of imported food (excluding fresh fruit and vegetables) registered the lowest figure in 1987 at 29,000 tons. At present, self-sufficiency of wheat can be realized along with other basic crops, such as corn, mandioca and poroto whose self-sufficiency has already been attained. Supply and demand of fruit and vegetables, on the other hand, are unstable compared with the above crops. The domestic supply rate against the total shipped volume at the ABASTO (Asuncion Central Food Wholesale Market) is about 80% and 20% of its depends entirely to the import. The national population is forecast to reach about 5.4 million in the year 2000. The population increase is calculated at an average of 2.7% for the period 1980 to 2000.

At present, self-sufficient of the annual consumption level per capita for cereals and tubers is almost achieved. Furthermore, it is estimated that the increased rate of consumption of these foods will be minimum as basic foods, however, consumption may increase in processed foods because consumption of sugarcane is increased as the materials for alcohol. On the other hand, the rate of self-sufficiency in vegetables and fruit is low compared with cereal foods. Therefore, an improved level of self-sufficiency and increased demand are anticipated with the expansion of domestic production.

3 NATIONAL DEVELOPMENT PLAN

3.1 Basic Consideration

The Government of Paraguay established the National Economic and Social Development Plan (1985-1989) in 1984. The main object of the development plan is to improve the income level by increased employment opportunities and improved productivity, enhanced export strength, expanded exports, consolidated domestic market and corrected social and economic differences through regional development. In order to achieve these objectives, the development policy emphasizes increased government investment and the enforcement of price policy (sustaining price, control of exchange rate, etc.) for the agricultural production sector as the nation's key industry.

3.2 Agricultural Development Policy

The main objectives of the agricultural sector, the most important part of the national development plan, are to improve the income level of rural inhabitants by augmenting productivity, diversify agricultural production, expand employment opportunities, conserve the natural environment and use the natural resources effectively. By carrying out the above policies, over 5.7% of a growth rate and 26.0% of a proportion of GDP in agricultural sector during the period of this plan will be established. Also, the plan calls for absorbing over 52.0% of the labor force into the rural area.

3.3 Target of Agricultural Production and Regional Agricultural Development Plan

The expected production of main agricultural products during the period of the plan is projected with the annual average growth rate of 13% for soybeans, 9.9% for sugarcane, 4.9% for wheat, 3.6 to 3.8% for maize, mandioca and poroto, 4.4 to 4.7% for onion, pumpkin and orange, 2.9 to 3% for plum, mango and grape. These expected production increase is marked exceeding the rate of population growth of 2.9%.

In the national development plan, integrated rural development projects are emphasized for promoting agriculture. Increasing designated crops suited to regional conditions is proposed for the main agricultural area, the eastern triangle zone, with apexes of Asuncion, Encarnacion in the south and Stroessner in the east.

4 GENERAL FEATURES OF DEPARTMENT OF PARAGUARI

4.1 General

The Department of Paraguari is situated adjacent to the Department of Central, where the capital Asuncion is located. The total area of the Department is 8,705 km². The National Route No. 1, the nation's main road running from Asuncion to Encarnacion, passes through some of the Department. In the north, the Altos Mountains range from east to west. The average gradient in this area is 5 to 10%. Other areas are flat, with gradients of 3% or less. The mean annual rainfall is 1,500 to 1,600 mm. The annual average temperature is 22°. The main streams and tributaries of the Tebicuary and Caanabe Rivers flow through this region, and, together with lake Ypoa, they are the most important water resources.

The Department is composed of 17 districts (distritos), separated into 282 villages (companias). About 80% of the population of 204,000 is distributed in the rural areas (National Population Census 1982). The population decreased by 0.4% during the period from 1972 to 1982. The economically active population is 135,000 equivalent to 66% of the population. The younger generation under 14 years of age makes up about 40% of the population, so the employable population will increase remarkably in the future.

The main industry of the Department of Paraguari is agriculture, agro-industry including sugar manufacture and cotton-carding, and cottage industry such as shoemaking and tanning. The agricultural sector in the Department occupies 70% of total production amount of the Department.

4.2 Agricultural Production

The number of farm households that hold land in the Department of Paraguari is about 26,000, for 11% of the number of the farm household in Paraguay. However, the ratio of the area of land owned is only about 3% (620,000 ha) of the total for the country. Consequently the area of land owned per farm household is smaller than that of the national average, and small scale farmers who own less than 20 ha amount to 90% of the total farmers. In addition, 54% of the total farmers are petty farm households owning less than 5 ha.

The main agricultural products in the Department of Paraguari are cotton and sugarcane as traditional cash crops, and maize, mandioca and poroto for self-consumption. The crops for self-consumption account for

60 to 70%. The arrival volume of fruit and vegetables produced in the Department of Paraguari at the ABASTO, has grown 17% per annum for the last three years (1985-1987). The agriculture in the Department of Paraguari trends extensive agriculture at the outskirts of urban areas due to the location of the area and the conditions of land holding. Further, Paraguari is positioned as the objective department on the "Vegetables and Fruit Production and Merchandising Promotion Project" conducted by the Government.

Integrated rural development project of the Department of Paraguari is to raise the living standards by means of improved roads, electricity, clinics and schools, acceleration of land registration and technical assistance and organizing farmers in the areas where many petty farmers and poor people live. The project is being executed by the ten institutions under the supervision of National Agricultural Production and Promotion Council and financial support of the International Agricultural Development Fund (IFAD). The entire project cost is about US\$ 52.3 million (International agencies; 70.6%, local funds; 29.4%). The implementation period for the initial stage of this project was set from 1982 to 1985, but was actually completed in 1987.

5 PRESENT CONDITIONS OF THE STUDY AREA

5.1 Physical Condition

The Study Area is located in 130 km south-east of Asuncion and situated on the plateau forming the most upstream reaches of Tebicuary-Mi river. Elevations of the Area varies from 130 m to 500 m and is composed sandstone and conglomerate. Sandy soils are covered with the surface layer then, the clayey soils are distributed in the Area. Major three streams named Tranquera, Rory and Rory-Mi are taken place as the water sources.

The land in the Study Area (11,000 ha) is classified broadly into four land categories, forest, arable land, pasture land and other (urban district, roads and riversides). The total area of each category obtained by estimation through a field survey based on aerial-photography and SEAG's materials is shown as follow:

Classification	Area (ha)	Land Use
Forest	2,800	Mountains above 250 m in elevation: 1,400 ha
Arable	4,600	Arable: 2,600 ha Fallow: 2,000 ha
Pasture	3,200	Lowland pasture: 2,800 ha

Classification	Area (ha)	Land Use
Urban, other	400	Urban district: 140 ha Other includes roads and riversides
Total	11,000	

5.2 Social and Economic Conditions

The Study Area is divided into 10 companies (villages) and one city as administrative divisions. The total population of the Area is about 5,000 and half and half are distributed in the rural and urban area. The major industry of the Area is agriculture of cotton, sugarcane, fruit and vegetables. Over 80% of the total households are engaged in agricultural production. The rest are involved in the retail trade (90 households), cottage industry (12 households) and services (30 households). The main agricultural supporting agencies are SEAG, BNF and Cooperative.

5.3 Agricultural Management

Farming in the Study Area can be classified into seven types as shown below.

- Type 1: cotton + crops for own consumption + (vegetables or mangoes) + livestock for own consumption.
- Type 2: sugarcane + crops for own consumption + livestock for own consumption.
- Type 3: vegetables + miscellaneous crops.
- Type 4: beef cattle + cotton + crops for own consumption.
- Type 5: fruit + miscellaneous crops.
- Type 6: vegetables + fruit.
- Type 7: fruit + miscellaneous crops + apiculture.

Most of the fruit and vegetables produced in the Study Area are shipped to the ABASTO market and consumed in the Asuncion metropolitan area. After the primary processing at the factory, most of the cotton shipped abroad, while sugarcane is processed to produce sugar or alcohol for domestic consumption.

In the Study Area, marketing channels for the principal agricultural products such as fruit and vegetables are different from cotton and sugarcane; methods of collection and shipment of products also

differ between members and non-members of the agricultural cooperative. The agricultural cooperative goes from one member farmer to another to gather their products, all of which, except grapes for processing, is sent to ABASTO. No definite systematic distribution systems have been established among farmers who are not members of the cooperatives. They commonly sell their products directly to brokers called ACOPIADOR.

A winery operated by the cooperative is located within the Study Area, constituting a major agricultural processing facility. Shortage of the production materials occurs in the area due to shipping of 40 to 50 % of wine production materials to the market as a fruit in connection with the market price. Cotton and sugarcane produced within the area are sent to a cotton mill and two sugar mills for processing. These factories, however, suffer from lack of raw materials. At present, a juicing factory is under construction in the Area. In the plan, this factory will produce pineapple juice and in the future, canning of fruit and vegetables and production of soft drinks will be started.

There are no government-level research centers in the Study Area. An experimental field (0.5 ha) for grape growing is operated privately by the wine-brewing association and a group to study cultivation of vegetables and fruit has been set up within the agricultural cooperative.

There is a SEAG La Colmena office in the Area. Farmers in the Study Area are expressing their desire to grow fruit and vegetables, shifting from the traditional crops such as cotton and sugarcane and pushing the trend toward diversification of products. This development has made it all the more important to have viable instruction systems on harvesting techniques, especially manuring management of fruit and vegetables, and an increase in the number of extension workers for this task.

Farmers' organization is the agricultural committee and the agricultural cooperative. There are two agricultural financial institutes in the Area: Bank of National Fomentation (BNF) and the Colmena Agricultural Industrial Cooperative. Outside the Study Area, there is Habilitation Agricultural Credit (CAH) established under the jurisdiction of MAG, whose sole purpose is to protect such small-scale farmers in line with the country's farm policies.

5.4 Social Infrastructure

The distribution of social capitals has unevenness greatly between the urban and rural areas. Although accumulation of social

infrastructures at the urban areas in La Colmena is superior than that of average in the Department of Paraguari except for rate of road pavement. As for the rural areas, accumulation of social infrastructures is much different in comparison with the urban areas as same as the rural areas in the other cities of Department of Paraguari.

The main roads with the area comprise Route 251, 805, 818 and 819, and these main roads are linking the Study Areas with the major cities in the country (Asuncion, Coronel Oviedo, Villarrica, Stroessner, etc.). Only Route 251, connected to Route 1 via Acahay, is paved. Rate of pavement for the main road within the area is 33%. The area has three provincial roads (818-1, 818-3 and 251-22) with a total length of 17.7 km. They run north-south without pavement. On the other hand, there are 39 farm roads with a total length of 61.3 km. They are not paved.

The urban area has one medical center. One head doctor who specializes in pediatrics, one gynecologist, one dentist and five nurses are engaging their duty. It is designed for initial examination and primary treatment, lacking facilities for treatment, oxygen inhalation, analyzing and dental treatment. Patients must be transferred to hospitals in Paraguari or Asuncion for serious treatment. However, people in the area seem anxious for urgent improvement of the center's shortcomings, such as inadequate medical as well as communication facilities, poor road and ambulance conditions.

There are eight schools for primary education consisting two main schools, and six branch schools. All the students are within 5 km of these schools, however, the Fatima branch school offers only the first two years and the Potrero Alto branch school the first three years of education, forcing the students to walk long distances to receive higher education. The Fatima branch is now being renovated while the schools at Caaty-Mi and Potrero Alto are dilapidated from age. The only auxiliary facility available is the exercise ground of the main elementary school. Each one junior high school and college are in the Area.

370 households (80%) in the urban district and 90 families (22%) in the rural areas have facilities to receive electricity. Although the rate can be increased to 100% for the urban district and 50% for the farming areas, many farmers remain without electricity because of the cost involved (leading wire, electricity charge, etc.). Basic power networks are established for the whole Study Area.

At the moment, telephones are installed at 100 places, but only one of them is located in the rural areas. The pay-phone is only one in

ANTELCO at urban area. The switchboards will be made automatic and the lines will be increased to 200 within three years, according to ANTELCO's long-term plan.

Water supply facilities are installed only in the urban area where 240 households, about half the total number, make use of them. The rest depend on private wells for drinking water. Potable water comes from two wells. Water is pumped up to the supply tower to be delivered to each family using gravity system. However, water is scarce during the dry season, necessitating rationing.

Sewers are almost nonexistent in the urban as well as rural areas. Most families dig holes inside their property to use as toilets.

Most families use simple ditches within their properties to let wastewater flow. Some households in the urban area discharge the water directly into the river. Also, garbage treatment is performed by individual family in the rural areas and unlawful disposal of garbage is being practiced resulting seriously polluting of natural environment being occurred.

On the subject of public facilities, only the urban area has parks and soccer fields available to the general public; there are a few private soccer fields in the rural area.

6 INTEGRATED RURAL INFRASTRUCTURE IMPROVEMENT PROJECT IN LA COLMENA

6.1 Basic Concept

The integrated rural infrastructure improvement project aims at promoting agriculture in the neighboring regions of the urban areas and increasing the farmers' income with an improvement of structure on agricultural production and facilitation of modernized farm management. At the same time, it also aims at activating the rural communities and accelerating the farmer's settlement in the rural areas through an improvement of rural living environments. An improvement plan proposed in the project will be verified through the present conditions in Paraguay taking the problems extracted from the study in La Colmena and an improvement level to be established into account. Then, a model rural community containing a distinction of the rural areas located near urban areas will be constructed.

To set up the improvement level of the project, the region as a whole should be united systematically to strengthen the deficiencies in social infrastructure in each district. Targets for the structuring of agricultural production as well as living standards to be furnished for model rural areas in the neighboring regions of the metropolitan areas will be proposed.

6.2 Necessities of Improvement

Problems of farm management and living environments in the project area are summarized below.

(1) Natural environment:

- (a) Mechanical farming with large-sized machines is unsuitable due to undulating topography, especially the sloping areas in the elevated land.
- (b) Due to sandy soil in the arable land, the water holding capacity of the soil is poor and damages from drought easily occur. Soil erosion also occurs easily.
- (c) It is difficult to forecast the drought season, except November, because of the uneven distribution of rainfall.
- (d) Due to the heavy rainfall, erosion of the arable land and damages to road facilities easily occur.
- (e) Due to the small river basin, water available for the irrigation and other purposes is not sufficient within the projected area. Groundwater available for project use is also scarce. With these circumstances, there are some places where drinking water cannot be ensured. It is difficult for the farmers themselves to provide irrigation facilities due to the undulating topography.
- (f) Low-land areas in the north part of the Area is always inundated since the riverbed slope of Tebicuary-Mi is gentle and causes poor drainage conditions.

(2) Farm management and farm household economy:

- (a) There are many farmers who cultivate cotton or sugarcane as a cash crop, and maize (inter cropping: poroto, bean) and cassava for self consumption. Each area is 1 to 2 ha. Moreover, they breed a few domestic animals (mainly dairy cows) to supplement their nutrition. Their net profit is estimated at about 600,000 to 900,000 G per year. This income is low compared with labor in other industries (1,430,000 G per year on average).

- (b) Farmers are highly motivated for intensive agriculture, but this is not progressing because of the constraints of natural conditions.

(3) Institutions and organizations:

- (a) Due to the non-fulfillment of a debt to the B.N.F. or the landless, some farmers have taken out loans from brokers. As a result, they are selling their products to the broker under unfavorable conditions.
- (b) Most of the farmers in the Area do not participate in cooperatives. Therefore, they are forced to use disadvantageous means of selling their products, purchasing materials, raising fund and so on.
- (c) Extension and supporting organizations need to be enhanced since prevailing technique for cultivation must be improved.

(4) Rural infrastructures:

- (a) Rural road networks are comparatively well ordered, but their functions are not fulfilled on account of the many damaged parts and structural defects. In particular, the roads which run through the southern part (mountainous region) are impassable.
- (b) Groundwater is used for drinking water. In some areas, well water dries up in the drought period.
- (c) The electrical distribution system does not cover the whole Study Area.
- (d) Eight primary schools are established including branch schools in the Area. Some of the branch schools are only for the lower classes. As for the higher classes of primary school, the distance to attend school comes to over 5 km. Therefore more schools are required.
- (e) A hospital serves the urban area, however, improvement of medical facilities, particularly emergency medical care facilities, is desirable.
- (f) Telephones serve almost all the urban area, but are nonexistent in the rural area. The communication system needs to be extended to the rural area.
- (g) La Colmena cooperative has a winery. The quality of the product will have to be improved since competition with the products of neighboring countries is serious.
- (h) Environmental pollution is a threat in the urban areas,

because of inadequate garbage disposal facilities.

The advantages of the project area are as follows:

- (a) Asuncion, capital of Paraguay, is the biggest market in the country. Radical growth of demand in this market is expected. Asuncion is two hours by car from the Area.
- (b) Multiple farm management based on fruit and vegetables is already being undertaken by some farmers.
- (c) La Colmena Agricultural Cooperative fully plays its functions regarding marketing, processing, credit, etc. though members of the cooperative are few in number at present.

The early way to promote agriculture in the Area is to make full use of existing resources, facilities and organizations. Popularization of farming technique among the farmers will also contribute to promotion of regional agriculture. Although a change in the farmer's awareness is of prime importance for agricultural promotion, on the other hand, government action on this matter is also required. As a method to promote regional agriculture, there is strong requirement for improvement of the agricultural and social infrastructure, such as water resource development, improvement of roads, etc., and evolution of agricultural management with a form of enterprise by cooperative organization and supporting services for the popularization of farming techniques.

6.3 Basic Concept for Improvement

The Project aims at taking measures to solve the problems of the living and agricultural environments in the Area, and also proposes a model rural community at the outskirts of Asuncion. Project planning will be carried out on the premise that the Project Area will be confirmed as a multiple farming area with fruit and vegetables. The population of the Project Area is forecast to level off or increase only slightly. Farmers income in the target year, after completion of the Project, is projected to grow about 6% per annum.

When the projects proposed in each field are implemented, those projects will be divided into two categories, depending on whether the execution is urgent or not and whether it is possible to undertake the project at an early stage or a preparation period is indispensable. Therefore, the projects will proceed in two stages taking the conditions stated above into consideration.

Initial Stage : Projects which have a higher priority can be undertaken at an early stage and will be effective in view of the direct and indirect benefit.

Future Stage : Projects which require adjustment with other projects and/or for which a preparation period is indispensable will also be required after developing the social and economic conditions of the Study Area in the near future.

6.4 Components of the Integrated Rural Infrastructure Improvement Plan

The Study Area still has virgin forest and wilderness. To conserve the environment, new land reclamation will not be undertaken. The development plan aims at 2,600 ha of existing farm land.

The project should be planned as an integrated and consistent structure. In agricultural development, the following three plans will be established.

- i) Improvement of agricultural management and water resources development
- ii) Improvement of farm roads
- iii) Strengthening and promotion of agricultural cooperative

In the agricultural production plan, cotton, sugarcane, fruit and vegetables will be the basic crops to formulate the proposed cropping pattern in the Area. Following is considered to establish the plan:

a) Cotton and sugarcane

Cultivation on both crops are encouraged on a nationwide scale with the government-set price. Production plan of the cotton, however, will be set same as present since productivity of the cotton production in the Area has been reached its limits. For sugarcane, production increase is planned because improvement of productivity is expected and the government is promoting campaigns to grow sugarcane that can be used not only for sugar production but as a material of fuel alcohol.

b) Vegetables

Production plan will be established corresponding to demand of the market in the metropolitan area. Especially, crops which have high marketability and imported due to shortage of supply will be set a production increase. With these, vegetables such

as onions, tomatos, green pepper and potatos are recommendable to meet the plan.

c) Fruit

Drastic production increase is difficult in view of farming technique and farm management fund. Taking these circumstances into account, elevation of profitability on present cultivated crops such as grape, plum, orange and mango will be planned with a transition of dominant species.

Cropping and production plans are estimated as follows with and/or without project conditions.

Crops	Without Project		With Project	
	Cropped Area (ha)	Production (ton)	Cropped Area (ha)	Production (ton)
Cotton	820	1,066	825	1,238
Sugarcane	255	17,850	500	37,500
Others	1,090	8,780	1,056	6,197
Vegetables	180	2,537	400	8,720
Fruit	182	1,445	200	2,575
Total	2,527	31,678	2,981	56,230

In the water resources development, the plan will formulate taking distribution of rural water including irrigation purpose and drinking water supply to the areas where water could not be ensured continuously into account. 400 ha of existing farm land, mainly fruit and vegetables, will be the objective areas for the Initial Stage improvement in the irrigation plan. As the irrigation plan in the Future Stage, 500 ha of farm land will be added to the area of Initial Stage. Then, 900 ha will be the objective areas. The rural water supply in the Initial Stage improvement will be planned with capacity of 333 households (2,150 persons) which can be applied the gravity system in the rural and urban areas. In the Future Stage plan, 72 households (450 persons) will be added the First Stage plan.

In the road improvement plan, review of the existing road network will be carried out taking the functions of main, provincial, and farm roads in the Area into consideration. Road structure improvements will be proposed at 64.3 km in the Initial Stage and at 21.3 km in the Future Stage improvements.

This Area has a particularly high concentration of independent farmers and small-scale farmers. It seems that the organized activities of the cooperative have been effective to meet the diversification in

demand for agricultural products and in the commercialization of agricultural production. Consequently, farmers will be encouraged to join the cooperative. Improvement of winery facilities (cooling system, measuring devices and repair of the buildings) will be proposed as the plan to strengthen the agricultural cooperative. As the improvement plan of the marketing and distribution system, new construction of collection and shipping facilities (640 m²) for fruit and vegetables. Both plans will be the Initial Stage improvement and storage facilities will be provided in the Future Stage improvement.

The rural facilities in the Area, following improvement plans are proposed.

- 1) Rural electricity
- 2) Medical care facilities
- 3) Telecommunication system
- 4) Extension, O & M center
- 5) Sub-center
- 6) Education facilities
- 7) Others

Electricity is already provided in part of the Area, where it has contributed to improving the living standard and agricultural management. Therefore, as the Initial Stage improvement, the extension of electricity with 46.8 km in 26 routes to the area where no electricity is installed will be proposed to accelerate the modernization of the living standard and agricultural management.

With an improvement of existing health center, the medical care system for the Study Area and its neighboring areas will be established. In particular, provision of emergency medical care and oxygen supply will be the Initial Stage improvement. Analytical equipment will be provided in the Future Stage improvement.

There is a lack of convenience on the telecommunication system in the rural area for emergency and daily use since only one telephone is available. Therefore, to improve the living and production environments, extension of telephone services is planned in conformity with the ANTEICO's long-term plan. For the Initial Stage improvement, installation of 3 distribution lines with 14 km in length and 8 public telephones. 3 distribution lines with 10.3 km in length and 12 public telephones will be installed in the Future Stage improvement.

O & M of facilities, distribution of water and collection of water charges are important items for promoting the Project. These must be executed by the farmers themselves. In the plan, an O & M organization and schedule will be proposed on the basis of the facilities plan for the Project. Construction plan of the Extension and O & M center is established in the Initial Stage improvement in line with the proposed organization and schedule.

As a part of enhancing education, health, technology, and communication, the Sub-center will be constructed by each committee. These sub-centers will contain a playground meeting hall, and public telephone, and will contribute greatly to a sense of community in the Area. In the Initial Stage improvement, 4 places of Sub-center where located far from the urban areas will be installed and remaining 6 places will be provided in the Future Stage improvement.

Improvement of education facilities will be planned repair of superannuated school houses, elimination of long-distance walking to attend the classes and upgrading of exercise facilities. In the Initial Stage improvement, repair of 2 existing school houses will be proceeded. Enforcement of full-grade schooling and provision of exercise ground at 6 schools will be planned in the Future Stage improvement.

As the other facilities, garbage treatment facility, demonstration farm and agricultural experimental center will be planned with each one in the Initial Stage improvement and 4 places of garbage treatment facilities and one sewage treatment facilities will be provided in the Future Stage.

Project components is shown in Table S-1.

7 PRIORITY PROJECT

The proposed priority project will be selected as the Initial Stage improvement with the view of urgency and effectiveness of the project in the Master Plan.

8 PROJECT COST

The cost for the implementation of the project is estimated at 31,840 million G for Master Plan and at 14,855 million G for the priority project.

Unit:1,000 G

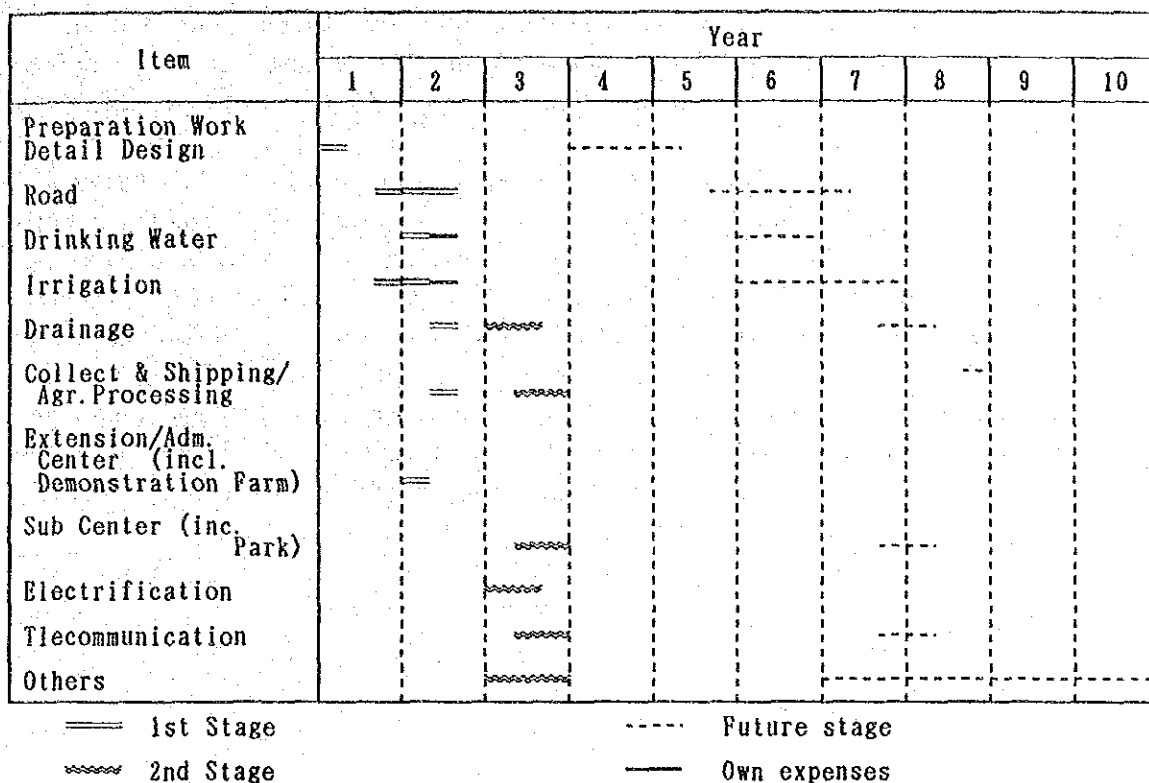
Projects	Priority project	Master plan
Road Improvement	4,738,521	8,337,000
Irrigation Water Supply	4,036,154	11,560,000
Drainage Improvement	103,422	254,000
Rural Water Supply	988,454	1,877,000
Electricity	1,308,000	1,308,000
Medical Care	154,000	231,000
Telecommunication	162,000	285,000
Education	100,000	192,000
Extension & Administration	169,000	169,000
Sub-Center	185,000	462,000
Rural Park	154,000	385,000
Garbage Treatment	192,000	2,115,000
Agr. Processing	423,000	962,000
Marketing	462,000	862,000
Demonstration Farm	22,999	23,000
O/M Machines	577,000	577,000
sub-total	13,775,550	29,599,000
Engineering Fee	1,080,000	2,241,000
Total	14,855,000	31,840,000

9 PROJECT EVALUATION

Based on the costs and benefits, EIRR has been calculated as $i = 12.1\%$ for the section which the direct benefits during the 50 years of the project life can be quantitatively expressed. The results of sensitivity analysis shows 10.7 to 14.7 %. These figures are considered to be appropriated.

10 PROJECT IMPLEMENTATION SCHEDULE

As the project executing body, establishment of a joint operation committee and a project implementation institution (CORDINACION) is proposed. Following project implementation schedule is recommended taking the project executing body and construction works into accounts.



11 CONCLUSIONS AND RECOMMENDATIONS

The project area locates at the outskirts of the metropolitan areas. With these locations, stabilized agricultural management and elevation of the farmers' income could be realized with promotion of a multiple farming through agricultural infrastructure improvements. Further, improvement of living environment will accelerate the settlement of the young generation in the rural areas. These improved situation will be essential further development in the Area. The project area has fundamentals to perform these measures and is suitable to execute the comprehensive rural infrastructure improvement plan as a model rural areas surrounding the metropolitan areas.

Through the study of the project, 31,840 million G in total is required to implement the project. Benefits such as increase of agricultural production of 1,027 million G, reduction of transportation cost of 1,176 million G, increase of employment opportunity and etc. are anticipated in conformity with the investment.

Further, investment to execute the priority project is estimated at 14,856 million G and economic internal rate of return (EIRR) is 12.1% with the required costs and anticipated benefits.

These figures are considered to be appropriated (the factor of inflation is not included) and the project is justified taking the spreading effects and etc. into account.

From the conclusions stated above, project given priority should be implemented in the early stage. The Government of Paraguay should also be performed the necessary measures to rise the funds and realized the executing body in detail. To reveal the projected effects in early stage, establishment and extension of farming technique including water management are indispensable. Strengthening of farmers' organization and financial assistance for the small scale farmers by the concerned officials will be expected. With these, concerned officials should be taken place at the stage of project planning and implementation.

Table S-1 Project Components

Project	Item	First Stage Improvement	Future Stage Improvement	Overall Components
1. Road Improvement	Pavement	1 route L= 5.5 km	1 route L= 6.3 km	1 route L=11.8 km
	Improvement	20 routes L= 64.3km	10 routes L=21.3 km	30 routes L=85.6 km
	Bridge	10 Nos	7 Nos	17 Nos
	Culvert	35 Nos	16 Nos	51 Nos
	Sub-base Improve.	-	L.S	L.S
2. Irrigation Facilities	Intake Structure	4 Places	1 Place	5 Places
	Pump Station	2 Places	2 Places	4 Places
	Regulating Pond	3 Places	3 Places	6 Places
	Conducting Pipeline	L=10.2 km	L=10.2 km	L=20.4 km
	Distribution Pipeline	L=29.8 km	L=35.3 km	L=65.1 km
	Reservoir On-farm	- 400 ha	1 Place 500 ha	1 Place 900 ha
3. Drainage Improvement	Drain	2 Routes L= 4.0 km	3 Route L= 6.0 km	5 Route L=10.0 km
	Conducting Pipeline	L= 800 m	-	L= 800 m
4. Rural water Supply	Regulating Reservoir	2 Places	-	2 Places
	Sedimentation Basin	2 Places	-	2 Places
	Slow Sand Filter Bed	2 Places	-	2 Places
	Disinfecting Chamber	2 Places	-	2 Places
	Distributing Reservoir	4 Places	3 Places	7 Places
	Distribution Pipeline	L=56,650m	L=13,400m	L=70,050m
	Pumping Station	-	3 Places	3 Places
	Service Hydrant	L.S	L.S	L.S
5. Electricity	Distribution Lines	26 Routes L=48.8 km	-	26 Routes L=48.8 km
	Oxgen Tent	1 Set	-	1 Set
6. Medical Care Facilities	Ambulance	1 No.	-	1 No.
	Analytical Equipement	-	L.S	L.S
	Distribution Lines	3 Routes L=14.0 km	3 Routes L=10.3 km	6 Routes L=24.3 km
7. Telecommuni- cation System	Public Phone	8 Nos	12 Nos	20 Nos
	Repair, School Houses	2 Schools	-	2 Schools
8. Education Facilities	Exercise Ground	-	6 Places	6 Places
	Center (Area)	800 m ²	-	800 m ²
9. O&M Center	Sub-center	4 Places	6 Places	10 Places
	(Area)	800 m ²	1,200 m ²	2,000 m ²
10. Rural Park	Park	4 Places	6 Places	10 Places
	(Area)	20,000 m ²	30,000 m ²	50,000 m ²
12. Sewege Treatment	Facilities	-	1 Place	1 Place
	Related population	-	2,500	2,500
13. Garbage Treatment	Facilities	1 Place	4 Place	5 Place
	(Area)	2,000 m ²	8,000 m ²	10,000 m ²
14. Agricultural Processing Facilities	Winery Cooling & Measuring device	L.S	-	L.S
	Processing Facilities	L.S	-	L.S
	Repair of Factory	L.S	-	L.S
	Storage (Low Temp.)	-	L.S	L.S
	Collecting & Shipping Facility (Area)	1 Place 640 m ²	-	1 Place 640 m ²
15. Marketing Facilities	Grading Equipment	-	L.S	L.S
	Storage (Low Temp.)	-	L.S	L.S
	Farm (Area)	1 Place 5,000 m ²	-	1 Place 5,000 m ²
16. Demonstration Farm	Machies	Buldozer, Grader	-	Buldozer, Grader
		Roller, Backhoe	-	Roller, Backhoe

CHAPTER 1 INTRODUCTION

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1.1 Background of the Study

In the Republic of Paraguay, agriculture is one of the key industries. The latest Five Year National Development Plan scheduled from 1985 to 1989 emphasizes the intensification of the agriculture sector which promotes the development strategy of enlargement of export, cultivation of new markets and provision of incentives for processing of agricultural products.

Due to the concentration of population in Asuncion and its surrounding area, the demand for perishable foodstuffs such as fruit, vegetables, etc. is increasing. However, the quantity and quality of both fruit and vegetables are still insufficient to meet demands because of small-scale farm management and inadequate facilities in the producing districts. A suitable arrangement for fruit production, storage and processing facilities is promptly required, not only to fulfill the domestic demand but also to allow exports to neighboring countries through increased production and quality, since at present domestic demand is fulfilled by imports from Brazil and Argentina. Domestic demand for vegetables has now increased but quality improvement and standardization are required, as well as production increases in the future.

Under these circumstances, La Colmena region in the Department of Paraguari Prefecture plays a major role in the production and supply of fruit and vegetables to Asuncion through the intensive agriculture on the initiative of exemplary good farmers. However, unstable production in this region is unavoidable due to constraints such as low water holding capacity of the soil, uneven rainfall distribution, small-scale farm management, insufficient facilities for agricultural production and living environments.

Taking the above mentioned factors into account, the Government of Paraguay has decided to conduct an integrated rural infrastructure improvement project in La Colmena to increase the agricultural productivity and to stabilize the agricultural income together with an improvement of the rural living standards. Furthermore, this project will be positioned as a pilot project for agricultural modernization in the neighboring regions of the urban areas. A spin-off effect in the neighboring rural areas is also anticipated and will contribute to the Paraguay Government's goal of self-sufficiency in fruit production.

Against this background, the Government of Paraguay requested the Government of Japan for a feasibility study on the Integrated Rural Infrastructure Improvement Project in La Colmena in July 1985. In response to this request, the Government of Japan, through the Japan International Cooperation Agency (JICA), sent a preliminary study team to Paraguay in January 1988. The Scope of Work for the Study was discussed and signed by and between both parties on February 2, 1988. Accordingly, it was decided to conduct the study of the project in line with the Scope of Work. The field study was executed in twice, during the period from July 26 to October 2, 1988 and November 1 to December 24, 1988. This report describes the basic plan and the priority project in detail based on the results of the field study.

1.2 Objectives of the Study

The objectives of the Study are:

- (1) To establish a basic program for the Integrated Rural Infrastructure Improvement Project for a betterment of the fundamentals of agricultural production and living standards in La Colmena region in the Department of Paraguari.
- (2) To execute a feasibility study on selected projects which have been selected as high priority projects within the said improvement plan, and
- (3) To perform a transfer of technology between counterpart personnel through the above Study.

1.3 Study Area

The Study Area which is the district of La Colmena, is located in the east of Department of Paraguari, 130 Km southeast of Asuncion. It is limited to the territory of the said district with an area of about 11,000 ha.

1.4 Scope of the Study

The Studies will execute to formulate a master plan covering the following fields to solve the constraints of agriculture and living environments in the Study Area. A feasibility study will also carry out for the selected priority projects in the said plan.

- (1) Irrigation and Drainage Plan
- (2) Land Use Plan
- (3) Improvement of Farm Management
- (4) Improvement of Farm Roads
- (5) Rural Water Supply Plan
- (6) Improvement of Rural Infrastructure
(Electrification, Medical Facilities, Education Facilities)
- (7) Improvement of Processing and Marketing Systems
(Winery Facilities, Collection and Shipping Facilities)
- (8) Improvement of Agricultural Institutions and Organizations
(Farmers organizations, Finance, Extension)
- (9) Promotion of Small-Scale Farmers
- (10) Project Implementation, and Operation and Maintenance of the
Facilities

**CHAPTER 2 GENERAL FEATURES
OF PARAGUAY**

CHAPTER 2 GENERAL FEATURES OF PARAGUAY

2.1 General

Paraguay, located from 19°10' to 27°40' Lat. S and from 54°10' to 62°20' Long. W., is a landlocked country encircled by Argentina, Bolivia and Brazil. The country's land area is around 407,000 km². The Paraguay River, flowing through the central part of the country from north to south, separates the country into two regions, the east and west. These regions differ in many aspects, such as type of land use, demography, and industry, because of the difference of meteorological conditions and location.

The western region, called "Gran Chaco", occupies 60% of the land. Topographically it is flat and monotonous. Annual rainfall ranges from 500 mm to 1,200 mm, and the temperature ranges between 40°C and 0°C. Compared with Gran Chaco, the eastern region covers 40% of the country, and has varied topography with hilly areas and undulating plains. The climate is sub-tropical and the mean annual temperature ranges from 21°C to 24°C. The temperature varies markedly but not as extremely as that of Gran Chaco. Annual rainfall ranges from 1,200 mm to 1,600 mm.

The population of Paraguay in 1987 was about 3.9 million, of which 97% was in the eastern region. Though the average annual growth rate of the population from 1974 to 1983 was 3.8%, the average growth rate for the last four years (1984-1987) has declined to 2.9%. The population of the metropolitan area centering around Asuncion, capital, is estimated at about 800,000.

The major industry is agriculture and agro-industry related to the agricultural products. Agricultural production of Paraguay contributed 26% of the GDP in 1987 and employed 500,000 people or 40% of the employed population (1.23 million). Thus, agriculture plays an important role for the nation's socio-economy.

2.2 National Economy and Agriculture

2.2.1 Role of Agriculture for the National Economy

(1) Gross domestic production

The growth rate of the agricultural sector in Paraguay was 6.8% from 1976 to 1981, but it has lowered to 0.5% for the last five years (1982-1986). The main causes of the slower growth rate are:

- 1) Continuous unseasonable weather, including large-scale inundation in 1983, damaged agricultural products.
- 2) Decreased international competitiveness and sluggish export trade for crops and processed agricultural products owing to fluctuating exchange rates.

The depression of the agricultural sector, the key industry of the country, meant a minus or lower growth rate for the GDP in the last five years (1982-1986) compared with at least 10% averaged from 1976 to 1981. However, the growth rate of the agricultural sector recorded 7% in 1987, and the GDP was 4.3%. Furthermore, the growth in GDP in 1988, is estimated to increase 6% than that of last year. The basic economy appears well on the way toward recovery.

The GDP for the last seven years and the growth rate by production sector are shown in Annex D Tables D.1.1 and D.1.2.

(2) Import and export of agricultural products and exchange rate system

The main export goods of Paraguay are soybeans, cotton, beef cattle and their processed goods. In particular, soybeans and cotton are heavily exported, accounting for 60 to 70% of total exports. Production goods such as machinery and petroleum account for 40 to 50% of total imports.

Among the consumption goods that have occupied a comparatively high ratio of the imports until now, foodstuffs have been decreasing because of stepped up domestic production of wheat. Major imports and exports over the last five years are shown in Annex D Tables D.1.3 and D.1.4.

(3) Prices, wage and employment

The average annual consumer prices rose 13% from 1970 to 1980, and by 22.5% for the last five years (1983-1987). Food is the major component of the consumer prices; food prices in 1987 rose by 42.3% over the preceding year.

The rate of increase in wages has not kept up with the rate of increase in prices. As shown in Annex Fig. G.1.1, real income has declined. The minimum wage in June, 1988 was 119,350 G/month.

The labor force of Paraguay was 1.23 million in 1987, equivalent to about 32% of the total population. In the five years from 1983 to 1987, the labor force increased at the rate of 2% per annum. The unemployment rate was 4.1% per annum from 1970 to 1981. In 1982, it rose suddenly to 15%, the maximum until now. It is said that much of this was caused by rising unemployment in the cities as a result of the depressed national economy. However, according to B.C.P., the unemployment rate in 1987 was estimated to have fallen to 8.7% (B.C.P, 1988).

2.2.2 Trend of Agricultural Production

(1) Land use and land holding

In 1987 cultivated land accounted for about 3.99 million ha and grassland for 19.9 million ha. The area of cultivated land increase by 5.2 times during the period from 1970 to 1987. In the same period, forests decreased by over 35% (8,520 ha). Consequently, forest area dropped from about 60% of the total area of Paraguay in 1970, to 38% in 1987. Present land use is shown as follows.

Unit:1,000 ha

Classification	1970 (%)	1975 (%)	1980 (%)	1985 (%)	1987 (%)
Agricultural Land	761 2	1,353 3	1,908 5	3,921 9	3,995 10
Pasture Land	14,850 37	15,644 39	17,653 44	17,995 44	19,959 49
Forestry	24,120 59	22,725 56	20,153 49	17,838 44	15,600 38
Others(*)	944 2	952 2	962 2	1,020 3	1,118 3
Total	40,675 100	40,675 100	40,675 100	40,675 100	40,675 100

* Others means urban area, rivers, lakes and roads

Source : (1) Encuesta Agropecuarias, 1982 - 1985, MAG

(2) Informacion Economicas Basicas, MIC, 1988

According to the 1981 agricultural census, the number of land holding farm households was around 0.24 million. The total land holding area was about 21.94 million ha (refer to Annex D Table 1.9). Small-scale farmers owning the farm land less than 20 ha accounted for about 80% of all farm households. Compared with the 1956 agricultural census, this was an increase of about 60% (92,000 farm households) in the number of farm households and about 23% (5.12 million ha) in land holding area. Growth of the land holding area was small compared with the increase in the number of farm households. Subdivision of farmland (on a small-

scale) appears to have progressed.

(2) Main agricultural production

Main agricultural products in the country are cotton, soybeans, sugarcane, wheat, maize, mandioca and poroto. Cotton and soybeans are mainly produced for export. The rest are for domestic markets or self-consumption. The harvest area and production of main agricultural products are as follows.

Year Crops	1975			1980			1985			1987			Increase rate*		Annual increase (%)
	Area	Produc- tion	Yield	Area	Produc- tion	Yield	Area	Produc- tion	Yield	Area	Produc- tion	Yield	Area (%)	Produc- tion (%)	
Cotton	100.0	99.6	0.99	258.3	227.5	0.88	385.9	469.3	1.2	339.5	420.6	1.2	340.0	420.0	12.8
Sugarcane	30.3	1,038.2	34.2	40.5	1,445.8	35.6	56.0	2,726.5	48.6	63.5	3,187.7	50.2	210.0	310.0	9.8
Corn	226.6	300.8	1.3	376.6	584.7	1.5	470.4	800.8	1.7	518.5	917.2	1.7	228.0	310.0	9.7
Mandioca	96.5	142.8	14.7	135.7	2,049.8	15.1	186.4	2,861.3	15.3	202.4	3,389.4	16.7	210.0	240.0	7.5
Porot	63.4	50.0	0.78	79.8	58.1	0.72	56.9	48.9	0.86	56.0	47.6	0.85	88.0	95.0	-0.4
Soy bean	150.2	220.1	1.4	357.1	543.9	1.5	718.8	1,172.5	1.6	676.1	1,025.4	1.5	450.0	470.0	13.7
Wheat	25.2	17.9	0.70	47.0	43.0	0.91	125.0	184.6	1.4	186.9	280.0	1.4	740.0	1564.0	25.5

* Unit : Area 1,000 ha, Production 1,000 ton, Yield ton/ha
Increase rate means during the 1975 to 1987.

Source: Los Principales Cultivos Durante el Periodo 1975 - 1988, MAG, 1988

Main agricultural products except poroto show a tendency to increase. In particular, the production of cotton and soybeans is increased markedly. In 1985 both cotton and soybeans recorded the highest production ever, of 469,000 tons and 1,172,000 tons respectively. This is five times as much as the 1975 production, and an increase of four times in harvest area. Further, the projection for this year (1988) is a growth of 7 to 10% in harvest area and 15 to 20% in production, compared with 1985 (Los Principales Cultivos durante el Periodo 1975-1988, MAG). To increase the demand for alcohol raw material in addition to sugar manufacture, both harvest area and production have been expanded.

(3) Livestock

Livestock is mainly beef cattle which number around 6.66 million head (MAG, 1987). The total quantity of beef cattle sold is 6.8 million ton, 66% for domestic consumption and the rest for export. In the last five years (1983-1987), the quantity of beef cattle has not changed but exports in 1987 were three times the 1985 level.

2.2.3 Demand of Principal Food

(1) Supply and demand

The amount of imported food (excluding fresh fruit and vegetables)

peaked in 1983 at 153,000 tons, followed by a yearly decrease, registering the lowest figure in 1987 at 29,000 tons (B.C.P. 1988). This is due to the increased domestic production of wheat, demand of which had been largely satisfied by imports. With this development, self-sufficiency for wheat can be realized along with other basic crops, such as corn, mandioca and potato whose self-sufficiency has already been attained.

Supply and demand of fruit and vegetables, on the other hand, are unstable compared with the above crops. The following data indicates volume of fruit and vegetables shipped into the ABASTO (Asuncion Central Food Wholesale Market), where products from throughout the country are gathered.

		Unit: 1,000 t											
Year	1982	%	1983	%	1984	%	1985	%	1986	%	1987	%	
Domestic Supply	120	80	123	81	112	88	134	84	116	85	129	84	
Imports	32	20	28	19	15	12	24	16	20	16	23	16	
Total amount	152	100	151	100	127	100	158	100	136	100	152	100	

Source: Informe Anual, 1986, 1987, ABASTO.

(2) Demand forecast of principal food

1) Population growth

According to the data of the population survey made by the Presidential Office in 1982, the national population is forecast to reach about 5.4 million in the year 2000 (Proyeccion de la Poblacion Urbana y Rural, Region y Departamental Periodo 1970 - 2000, Presidencia de la Republica, 1982). The population increase is calculated at an average of 2.7% for the period 1980 to 2000.

On the other hand, it is predicted that the rate of population growth in Asuncion and Department of Central is going to be higher than the national average during the same period. The following shows the estimated population growth rate for the future.

		Unit: 1,000 hab.					
Year	1980	1985	1990	1995	2000	Annual growth rate(%)	
(a) Country	3,168	3,681	4,231	4,807	5,405	2.7	
(b) Asuncion	501	597	706	804	900	3.0	
(c) Central	400	477	566	629	798	3.5	
(d) (b) + (c)	907	1,074	1,272	1,483	1,698	3.5	

2) Forecast food demands

Supply and demand for the principal agricultural products are shown in Table 2.1. The forecast for principal food demands is summarized in Table 2.2; the estimates are based on the data of recent trends in supply and demand for the principal agricultural products and according to projected population rates.

At present, the annual consumption level per capita for cereals and tubers is almost equal to or more, in some cases, than that of Brazil and Argentina. And Paraguay is self-sufficient in these foods with the exception of wheat. Furthermore, it is estimated that the increased rate of consumption of these foods will be minimum as basic foods, however, consumption may increase in processed foods, because consumption of sugarcane is increased as the materials for alcohol.

On the other hand, the rate of self-sufficiency in fruit and vegetables is low compared with cereal foods. Therefore, an improved level of self-sufficiency and increased demand are anticipated with the expansion of domestic production. In particular, annual consumption per capita of vegetables is half that of Argentina (annual consumption per capita is 70.1 kg). Due to the improvement of living standards an expansion of the demand is expected.

2.3 Administrative Organization of Paraguay

The head of the Paraguay Government is a president who directs the central administrative organ. Annex D. Fig.1.2 shows the organization chart for the central administration in the country.

As indicated in the chart, the Ministry of Agriculture and Livestock (MAG) is divided into the Cabinet ("Gabinete") and General Management ("Direccion General"). The Cabinet, comprising seven agencies including Agriculture Production Promotion and Committee and B.N.F., controls six agencies including Habilitation of Agricultural Credit (CAH) and Forestry Agency. The General Management consists of ten offices, including Agricultural Extension Service and Agriculture, Livestock and Forestry Survey. The ten offices, via the branch offices throughout the country, provide technical guidance, experimentation and research.

2.4 National Development Plan

2.4.1 Basic Consideration

The Government of Paraguay established the National Economic and Social Development Plan (1985-1989) in 1984. The main object of the development plan is to improve the income level by increased employment opportunities and improved productivity, enhanced export strength, expanded exports, consolidated domestic market and corrected social and economic differences through regional development. In order to achieve these objectives, the development policy emphasizes increased government investment and the enforcement of price policy (sustaining price, control of exchange rate, etc.) for the agricultural production sector as the nation's key industry.

The development plan consists of six parts: production, finance, trade, investment, financing and society. Target values to be achieved during the effective period of the plan are given to each part. The major values expected to be achieved are as follows:

Item	Expected Growth rate (%) 1985 - 1989	Past Records(%) 1980 - 1984
Gross domestic production	6.1	3.7
Export	9.5	-9.5
Import	7.5	0.0
Total supply	6.3	3.1
Total consumption	4.9	6.4
Total investment	9.4	1.5
Investment by government	6.8	-1.1
Public investment (agricultural sector)	12.1	*18.1
Growth rate of population	2.78	3.4
Working population	4.0	-
Rate of unemployment (1989)	4.8	8.7

* Rate of former national development plan.

2.4.2 Agricultural Development Policy

The main objectives of the agricultural sector, the most important part of the national development plan, are to improve the income level of rural inhabitants by augmenting productivity, diversify agricultural production, expand employment opportunities, conserve the natural environment and use the natural resources effectively. The plan proposes the following main agricultural policies:

- Exchange and tariff policies for export-import agricultural products and import production materials
- Improvement policy of marketing and distribution system of agricultural products for domestic and foreign markets
- Financing policy for small-scale farmers through government agencies such as BNF, CAH and IBR
- Technical assistance for agriculture, livestock and agro-industry
- Land holding policy by colonization and acceleration of obtaining the title deed
- Allotment of local cost for international cooperation project aiming to integrated agricultural development and regional promotion

By carrying out the above policies, over 5.7% of a growth rate and 26.0% of a proportion of GDP in agricultural sector during the period of this plan will be established. Also, the plan calls for absorbing over 52.0% of the labor force into the rural area.

2.4.3 Target of Agricultural Production and Regional Agricultural Development Plan

The expected production of main agricultural products during the period of the plan is shown in Annex D Table G.1.8. The annual average growth rate is 13% for soybeans, 9.9% for sugarcane, 4.9% for wheat, 3.6 to 3.8% for maize, mandioca and poroto, 4.4 to 4.7% for onion, pumpkin and orange, 2.9 to 3.0% for plum, mango and grape. These expected production increase are marked exceeding the rate of population growth of 2.9%.

In the national development plan, integrated rural development projects are emphasized for promoting agriculture. Increasing designated crops suited to regional conditions is proposed for the main agricultural area, the eastern triangle zone, with apexes of Asuncion, Encarnacion in the south and Stroessner in the east.

The main agricultural development projects are shown below:

Project	Area
a) Agricultural Development Project on Alto Parana and Dept. Itapua	- Alto Parana - Itapua

Project	Area
b) Production & Merchandising for Vegetables and Fruit	- Cordillera - Paraguari - Central - Caaguazu - Amambay - Itapua - Itapua
c) Principal Grain Production Increase Project in Central Area of Dept. of Itapua	- Itapua
d) Integrated Rural Improvement Project (Model Project)	- Paraguari and others
e) Integrated Rural Development Project in North of Itapua	- Itapua

2.5 General Features of Department of Paraguari

2.5.1 General

The Department of Paraguari is situated from 25°50' to 26°50' Lat. S and 58°60' to 56°60' Long. W., and is adjacent to the Department of Central, where the capital Asuncion is located. The total area of the Department is 8,705 km². The National Route No. 1, the nation's major road running from Asuncion to Encarnacion, passes through some of the Department. In the north, the Altos Mountains range from east to west. The average gradient in this area is 5 to 10%. Other areas are flat, with gradients of 3% or less.

The mean annual rainfall is 1,500 to 1,600 mm. The annual average temperature is 22°, but the range is from minus 2.2°C (July) to 48°C (January). The main streams and tributaries of the Tebicuary and Caanabe Rivers flow through this region, and, together with lake Ypoa, they are the most important water resources.

The Department is composed of 17 districts (distritos), separated into 282 villages (companias). About 80% of the population of 204,000 is distributed in the rural area (National Population Census 1982). The population decreased by 0.4% during the period from 1972 to 1982. The economically active population is 135,000 equivalent to 66% of the population. The younger generation under 14 years of age makes up about 40% of the population, so the employable population will increase remarkably in the future.

The main industry of the Department of Paraguari is agriculture, agro-industry including sugar manufacture and cotton-carding, and cottage industry such as shoemaking and tanning. 70% of the total production

amount was produced by the agricultural production sector (Proyecto de Desarrollo Rural Integrado del Departamento de Paraguari).

2.5.2 Agricultural Production

(1) Number of farm households and land holding

The number of farm households that hold land in the Department of Paraguari is about 26,000, for 11% of the number of the farm household in Paraguay. However, the ratio of the area of land owned is only about 3% (620,000 ha) of the total for the country. Consequently the area of land owned per farm household is smaller than that of the national average, and small scale farmers who own less than 20 ha amount to 90% of the total farmers. In addition, 54% of the total farmers are petty farm households owning less than 5 ha (refer to Annex D Table 13).

(2) Production trends of main agricultural products

The main agricultural products in the Department of Paraguari are cotton and sugarcane as traditional cash crops, and maize, mandioca and poroto for self-consumption. The crops for self-consumption account for 60 to 70%. The ratio of harvest area and production of agricultural products in the Department to those of the whole country are tabulated below (1986/1987).

Crops Year	Cotton		Sugarcane		Maize		Mandioca		Poroto	
	Area	Q'ty	Area	Q'ty	Area	Q'ty	Area	Q'ty	Area	Q'ty
Average (%) 1970 - '80	20.1	19.0	17.8	19.7	14.7	12.4	13.8	12.3	15.7	13.7
1986/'87 (%)	10.4	7.8	12.1	11.3	9.4	7.3	9.4	7.3	10.5	8.8

The production ratio of each item above to the national production is on the decline. However, the production of fruit and vegetables is increasing. The arrival volume of fruit and vegetables produced in the Department of Paraguari at the ABASTO, has grown 17% per annum for the last three years (1985-1987). Of the total received volume at the ABASTO, onion and pumpkin account for 30% and grape and plum account for 90%.

The agriculture in the Department of Paraguari trends extensive agriculture at the outskirts of urban areas due to the location of the area and the conditions of land holding. Further, Paraguari is positioned as the objective department on the "Vegetables and Fruit Production and Merchandising Promotion Project" conducted by the Government.

- (3) Integrated rural development project of the Department of Paraguari (Proyecto de Desarrollo Rural Integrado del Departamento de Paraguari)

To promote the regional economy through the improved agricultural productivity and light industry (agro-industry and cottage industry), the integrated rural development projects are being carried out in four departments including Paraguari. This development project in Paraguari is outlined below.

The objective of this project is to raise the living standards by means of improved roads, electricity, clinics and schools, acceleration of land registration and technical assistance and organizing farmers in the areas where many petty farmers and poor people live. The project is being executed by the ten institutions described below under the supervision of National Agricultural Production and Promotion Council (Consejo Nacional de Fomento de la Produccion Agricola) and financial support of the International Agricultural Development Fund (IFAD).

ANDE	(NATIONAL ELECTRICITY ADMINISTRATION)
BNF	(BANK OF NATIONAL FOMENTATION)
IBR	(RURAL WELFARE INSTITUTE)
INTN	(NATIONAL INSTITUTE OF TECHNOLOGY AND NORMALIZATION)
MEyC	(MINISTRY OF EDUCATION AND CULTURE)
MOPC	(MINISTRY OF PUBLIC CONSTRUCTION AND COMMUNICATION)
MSPyBS	(MINISTRY OF WELFARE)
SEAG	(AGRICULTURE AND LIVESTOCK EXTENSION SERVICE)
SNPP	(NATIONAL SERVICE OF PROFESSIONAL PROMOTION)
SPA	(ARTISAN PROMOTION SERVICE)

The entire project cost is about US\$ 52.3 million (International agencies; 70.6%, local funds; 29.4%). The sub-projects to achieve the objectives are as follows:

Sub-project	Target
a) Financing	: Financing to the amount of US\$27.0 million for 7,700 small-scale farm households of less than 20 ha (area of land holding) and 563 households engaged in cottage industry.
b) Organization	: Organization of 250 agricultural commissions and 10 groups of household industry associations.

to be continued

Sub-project	Target
c) Road project	: Road improvement and operation and maintenance 968.1 km. Construction and restoration of bridges: 80 bridges. Improvement of sewerage 638 places.
d) Land consolidation and land registration promotion project	: Farm land consolidation: 9,187 ha. Beneficiaries; 1,500 farm households. Farm household aimed at land registration; 3,276 farm households.
e) Rural electricity project	: 17 companies (villages) : Extension of electricity supply: 66 km
f) Public health project:	: Establishment of 9 health centers (6 new centers, 3 improved centers).
g) Education project	: Provision of 72 educational facilities (construction of 32 primary schools).

Implementation of the project promises to create new employment opportunities for 5,000 persons in the Department (agricultural sector: 80%, household industry sector: 20%). The implementation period for the initial stage of this project was set from 1982 to 1985, but was actually completed in 1987.

Table 2. 1 Trend of the Supply and Demand of the Principal
Agricultural Products

Unit:1,000 t

Year Products	1980			1985			1987		
	Domestic consumption (A)	Domestic Production (B/A) (B)	%	Domestic consumption (A)	Domestic production (B/A) (B)	%	Domestic consumption (A)	Domestic production (B/A) (B)	%
1.Cereals									
Rice	40.8	40.8	100.0	96.2	96.2	100.0	105.2	105.2	100.0
Maize	559.3	584.7	105.0	800.8	800.8	100.0	917.2	917.2	100.0
Wheat	118.0	43.0	36.4	267.2	184.5	69.0	350.3	330.8	96.7
Mandioca	2,049.8	2,049.8	100.0	2,861.3	2,861.3	100.0	3,389.4	3,389.4	100.0
2.Sugar	78.1	78.1	100.0	58.6	69.0	120.0	97.3	104.2	110.0
3.Beef	369.5	441.4	120.0	272.3	311.9	115.0	238.4	416.6	175.0
4.Vegetables	105.0	90.0	85.7	113.0	96.0	85.0	107.0	92.0	86.0
Fruits	47.0	30.0	63.0	45.0	38.0	84.0	45.0	37.0	82.0
5. Self-sufficiency ratio of cereals (%)			85.4	-	-	92.3	-	-	99.2
6. Self-sufficiency ratio of vegetables & fruit (%)			74.8	-	-	84.5	-	-	84.0

Remarks: (1) Domestic Consumption = Domestic Production + Quantity of Imports - Quantity of Exports

(2) Ratio of Self-sufficiency = $\frac{\text{Domestic Production}}{\text{Domestic Consumption}} \times 100(\text{Quantity})$

(3) Unit of Beef:1,000 head

(4) Vegetable & Fruits are calculated based on the market area of the ABASTO

(5) (B/A) % means self-sufficiency ratio

Sources: (1) Direccion de Censo y Estandisticas Agropecuarias, MAG 1988

(2) Boletin Estandistico, B.C.P 1988

(3) Sintesis de la Economia en CIFRAS, B.C.P 1988

(4) Informaciones Economicas Basicas, MIC 1988

(5) Informe Annual(1986,1987) ABASTO 1988

Table 2. 2 Forecast of the Food Demand

Foods		year	1987 (A)	2000 (B)	2000/1987 (B)/(A) %
1. Cereals	Total demand(1,000 t)		1,373.0	2,100.0	153.0
	Per capita (kg)		82.4	99.5	109.0
2. Tubers	Total demand(1,000 t)		3,500.0	4,865.0	139.0
	Per capita (kg)		229.2	299.0	87.0
3. Sugar	Total demand(1,000 t)		100.0	100.0	100.0
	Per capita (kg)		29.9	25.0	119.0
4. Beef (dressed)	Total demand(1,000 head)		238.4	242.1	102.0
	Per capita (kg)		59.7	65.0	110.0
5. Vegetables	Total demand(1,000 t)		123.6	378.5	306.0
	Metropolitan(1,000 t)		34.0*	119.0	350.0
	Per capita (kg)		31.7	70.1	221.0
Fruits	Total demand(1,000 t)		506.2	702.0	138.0
	Metropolitan(1,000 t)		138.8*	220.7	159.4
	Per capita (kg)		129.8	130.0	101.0

Remarks : (1) Forecasts for total domestic demands(1~4) are calculated from the agricultural production increase rate of the National Development Plan.

(2) Total demand for vegetables & fruits = population in the year 2000 x consumption of per person

(3) Food consumption per person per year is calculated by the data in the trends of food consumption in Paraguay (Ministry of Welfare) and food consumption per person per year in Argentina(OECD)

(4) Metropolitana population is based on 1985 year.

Note : (1) "Total demand" means total domestic demand

(2) "Per capita" means food consumption per person per year

(3) "Metropolitan" means metropolitan area

Sources : (1) Encuesta Nacional de Nutricion Republica del Paraguay, 1978 Ministerio de Salud Publica y Bienestar Social

(2) Proyeccion de la Poblacion Urbana y Rural, Regional y Departamental por sexo y grupos de edades. Periodo 1970 - 2000, Presidencia de la Republica 1981

(3) Food Consumption Statistics 1964 -1978, OECD

(4) Provisional food balance sheets, 1980 FAO

(5) Plan Nacional de Desarrollo(1984 - 1989)