

No. 2

REPUBLIC OF BOLIVIA

JAPAN INTERNATIONAL
COOPERATION AGENCY
(JICA)

THE FEASIBILITY STUDY
ON
AGRICULTURAL DEVELOPMENT
OF
ACHACACHI AREA, DEPARTMENT OF LA PAZ

MAIN REPORT

November, 1997

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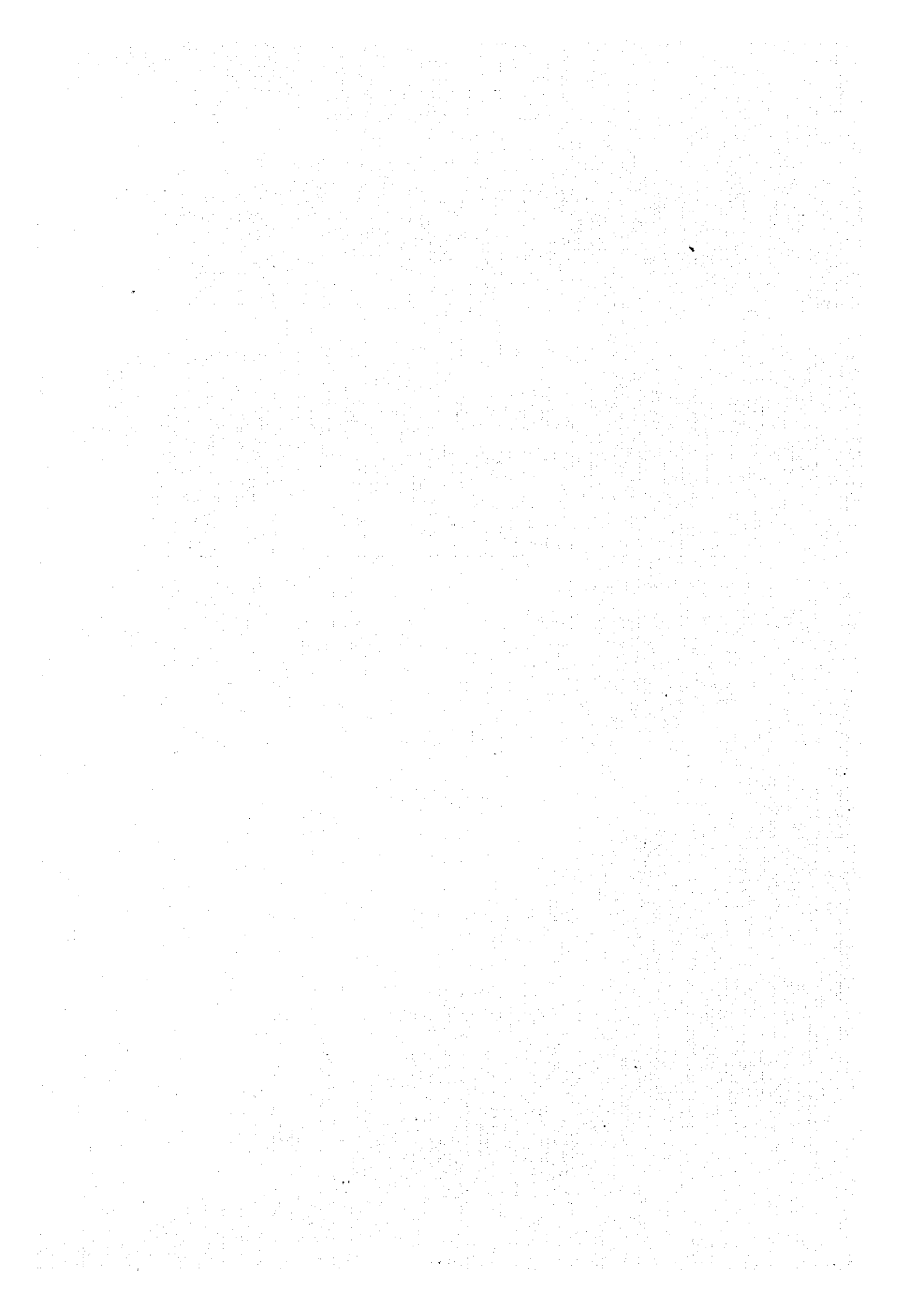
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REPUBLIC OF BOLIVIA
THE FEASIBILITY STUDY
ON
AGRICULTURAL DEVELOPMENT OF ACHACACHI AREA
DEPARTMENT OF LAPAZ

COMPOSITION OF FINAL REPORT

Volume - 1 MAIN REPORT

LOCATION MAP & PHOTOS
SUMMARY
ABBREVIATIONS
MAIN REPORT
ATTACHMENT

Volume - 2 ANNEXES

ANNEX A AERIAL PHOTOGRAPHIC SURVEY
ANNEX B SOILS AND LAND USE
ANNEX C METEO-HYDROLOGY
ANNEX D RURAL SOCIETY
ANNEX E AGRICULTURE
ANNEX F LIVESTOCK
ANNEX G WATER MANAGEMENT AND IRRIGATION
ANNEX H RURAL INFRASTRUCTURE
ANNEX I FARMER'S ORGANIZATION
ANNEX J AGRICULTURAL SUPPORT SERVICES
ANNEX K SOCIO AND AGRO-ECONOMY
ANNEX L DESIGN AND COST ESTIMATION
ANNEX M ENVIRONMENT
ANNEX N PROJECT EVALUATION
ANNEX O FARMER'S INTENTION SURVEY
ANNEX P WORKSHOP
ANNEX Q MINUTES MEETING

Exchange Rate

The exchange rate is follow:

Bs. 1.00 = US\$ 0.191 = Yen 22.2

July 1997



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P R E F A C E

In response to a request from the Government of Republic of Bolivia, the Government of Japan decided to conduct a development study on the Agricultural Development of Achacachi Area, Department of La Paz and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Bolivia a study team headed by Mr. Hisashi Terakado, Naigai Engineering Co., Ltd., from November, 1996 to December, 1997. (Three times between November, 1996 and December, 1997.)

The team held discussions with the officials concerned of the Government of Bolivia, and conducted field surveys at the study 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 promotion of the project and to the enhancement of friendly relations between our two countries.

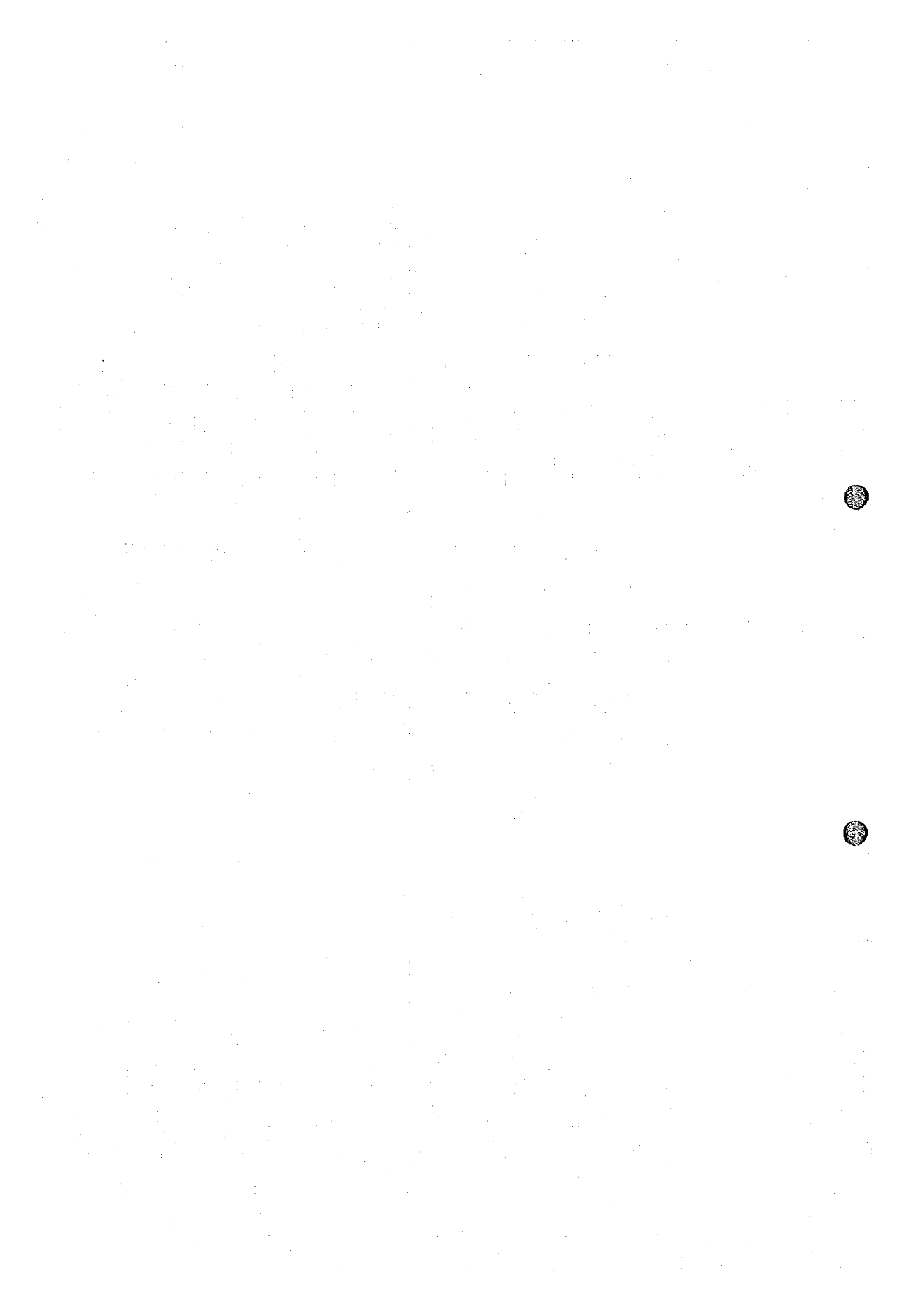
I wish to express my sincere appreciation to the officials concerned of the Government of Bolivia for their close cooperation extended to the team.

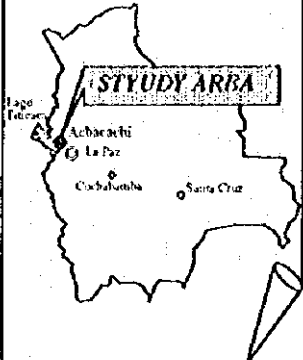
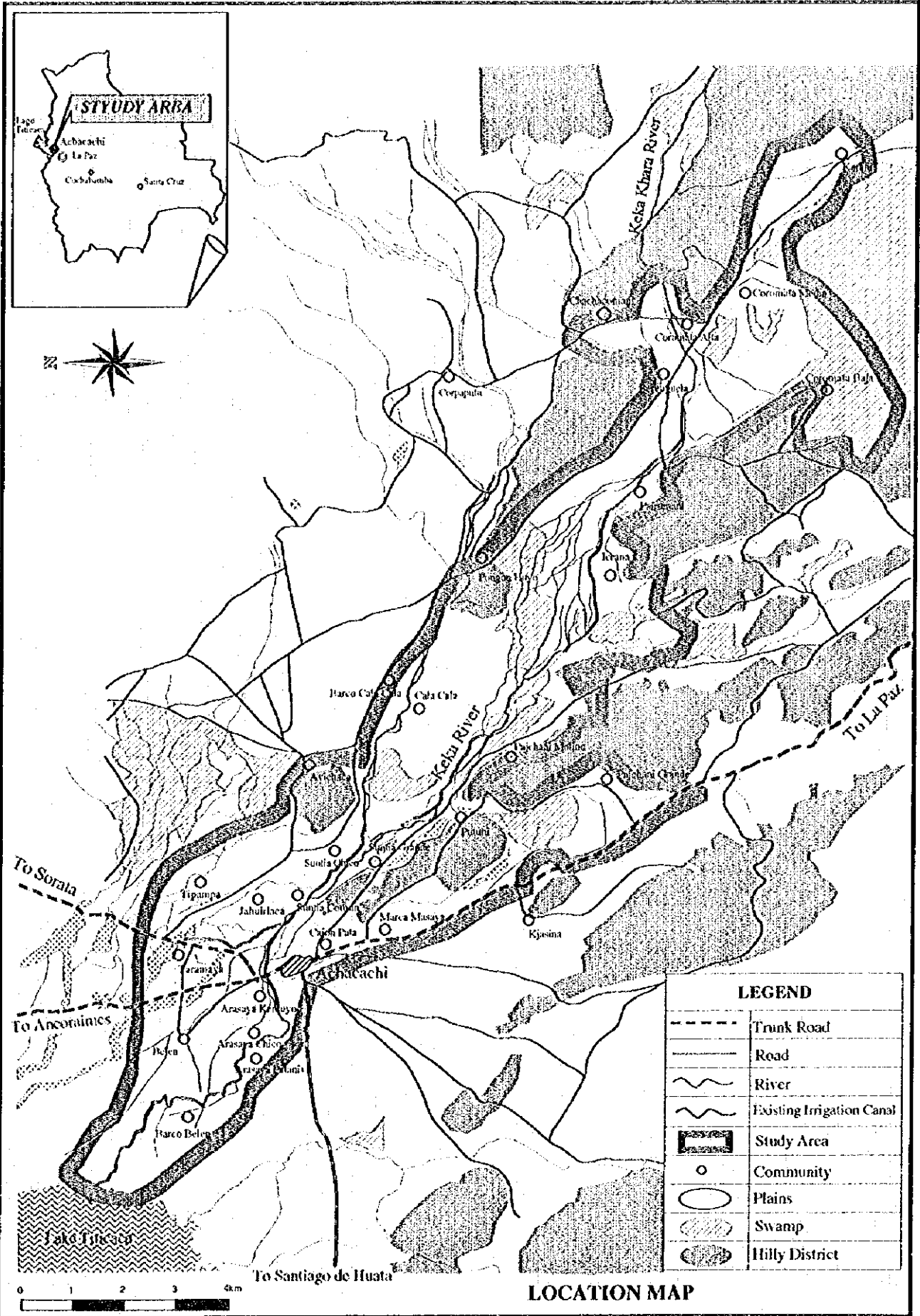
November, 1997



Kimio Fujita
President

Japan International Cooperation Agency





To Sorata

To Anconaimas

Lake Titicaca

To Santiago de Huata

Keta Khara River

Keta River

To La Paz

Barco Calaca

Caba Caba

Suola Chaca

Tipampa

Jahulbea

Chon Pata

Marco Masaya

Kjesma

Asnacachi

Arasaya Chico

Arasaya Khatayo

Dejen

Barco Belen

Corobaca

Coromoto

Coromoto Alto

Chiriquita Flaj

Coroputa

Itogona

Rhano

Barco Chaca

Barco Chaca

Barco Chaca

Barco Chaca

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**Explanation Meeting of the Study
in Chachacomani**

Participant Communities :

- Chachacomani
- Corpaputu
- Berenguela



**Explanation Meeting of the Study
in Kerani**

Participant Communities :

- Kerani
- Coromata Alla
- Coromata Media
- Coromata Baja



**Explanation Meeting of the Study
in Pairumani**

Participant Communities :

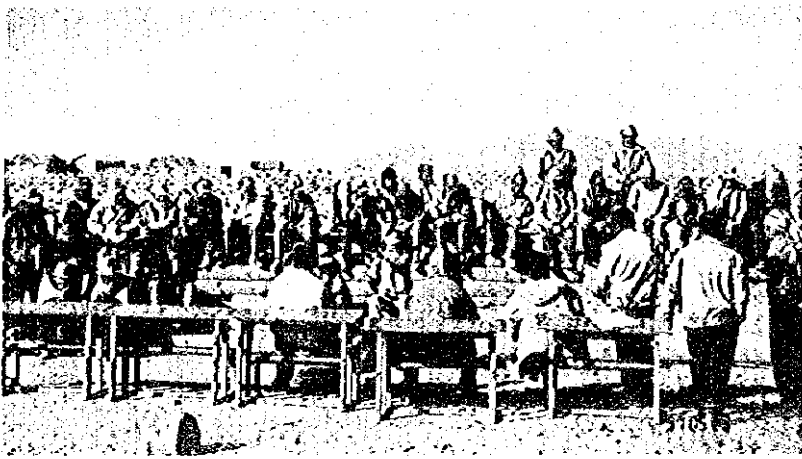
- Pairumani
- Icrana



**Explanation Meeting of the Study
in Pajchani Molino**

Participant Communities :

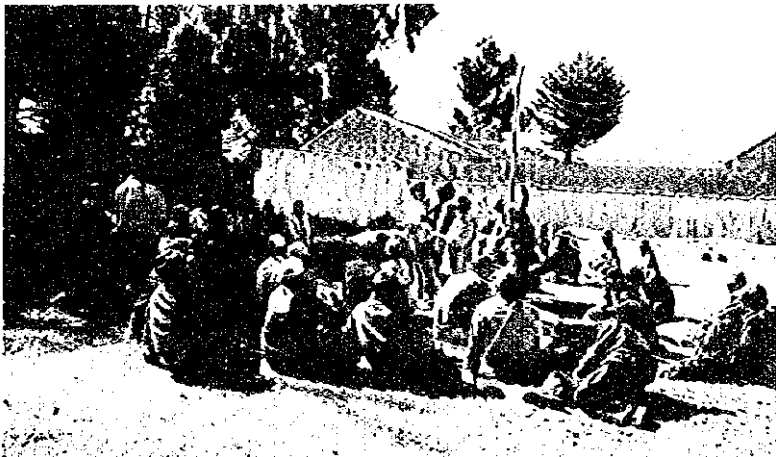
- Pajchani Molino
- Pajchani Grande
- Putuni



Explanation Meeting of the Study
in Cala Cala

Participant Communities :

- Cala Cala
- Barco Cala Cala
- Pongon Huyo



Explanation Meeting of the Study
in Avichaca

Participant Communities :

- Avichaca
- Tipampa



Explanation Meeting of the Study
in Suntia Comun

Participant Communities :

- Suntia Común
- Suntia Grande
- Suntia Chico
- Jahuirlaca



Explanation Meeting of the Study
in Marca Masaya

Participant Communities :

- Marca Masaya
- Kjasina



Explanation Meeting of the Study
in Arasaya Chico

Participant Communities :

- Arasaya Chico
- Arasaya Kentuyo
- Arasaya Patanivi
- Cajón Pata



Explanation Meeting of the Study
in Belén

Participant Communities :

- Belén
- Barco Belén
- Taramaya



Meeting with the Beneficiaries in
the Study Area, Explanation on
the Outline of the Study

(Phase I Study)



Filling out the Questionnaire
after the Meeting (Phase I Study)



Participants of the Workshop
(Representatives of the Beneficial
Communities) (Phase I Study)



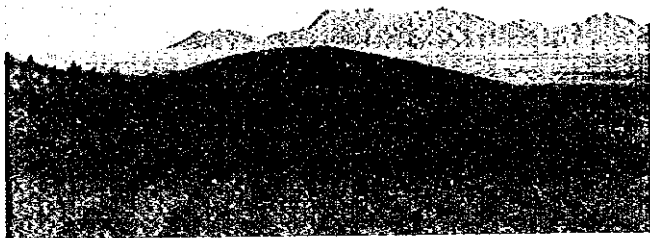
Explanation of the Phase II Study
Results at the Workshop



Explanation of the Draft Final Report
(Representatives of the Beneficial
Communities)



Harvested Oats
(for Cattle Feed in Winter)



Potato Field



Intake (No.40: Avichaca)



Intake (No.56: Pongon Huyo)



Main irrigation Canal and
Construction site of Proposed Bridge
(No.27: Coromata Alta)



Existing Road (Putuni)



Existing Road (Pajchani Molino)



A View of Collecting Milk by APLEPO



Achacachi Market



**The Feasibility Study
on
Agricultural Development Of Achacachi Area,
Department of La Paz**

Main Report

SUMMARY

1 Introduction

The Government of Bolivia requested the Government of Japan in October 1995 to undertake a Feasibility Study on Agricultural Development in the Achacachi area, Department of La Paz, which was designated as a priority development area in the "Regional Agricultural development Program joint to Intermediate Cities". In response to the request, the Government of Japan dispatched the Preparatory Study Team through JICA, and agreed on the Scope of Work for the Study in July 1996. The Study was conducted in two steps; Phase I and Phase II. During the Phase I Study from middle of November 1996 to end of March 1997, comprehensive basin study was carried out and basic development plans of the Study were subsequently identified. In the Phase II Study from beginning of May 1997 to December 1997, further study and analysis of the objective areas were carried out and the development plans of the Study were finally formulated. This Report describes results of field study and detailed development plans derived from the analysis of present situation of the Study area.

2 Background

The agriculture in Bolivia is divided roughly into two farming systems: traditional farming system (small-scale and self-sustaining) performed mainly in the Altiplano and Valle, and a comparatively new farming system (large-scale and enterprising) developed in the Llanos. The Altiplano and Valle, which hold at about 70 % of a total population in Bolivia, still play important social and economic role of the country, however, over 80 % of a rural population in these areas suffer poverty situation. Migration of these rural habitants to large cities is now causing social problems such as excessive concentration of population in large cities.

Taking these social situations into account, SNAG was established in 1993 an "Regional Agricultural Development Program Joint to Intermediate Cities" in line with the "Basic Plan for Intermediate Sector Development 1994-1997" which is the basic strategy for promoting agriculture of the country. The program intends to alleviate the poverty situation and to control the migration flow into large cities through improvement of infrastructures for the agricultural production and the living environment in leading rural cities and its outskirts.

3 Objectives of the Study

The objectives of the Study are to conduct the feasibility Study in order to formulate a rural and agricultural development plan in Achacachi area, and to carry out technology transfer to the counterpart personnel of the Bolivian Government during the course of the Study.

4 Study Area

The Study area covers a area of approximately 8,000 ha of Achacachi municipality and its peripheral rural areas (middle and down stream reaches of the Keka river) in Department of La Paz.

5 National Background

(1) Land and Population

Bolivia is broadly divided into three geographical zones on the basis of the topographical features and climate, mountainous and plateau zone called as Altiplano with the altitude of around 4,000 m, valley zone called as Valle ranging from 1,000 to 2,500 m in altitude and the eastern plain named as Llanos with the altitude of 200 to 500m. Total area of the country is 1,098,600 km² and agricultural land counts at 28,794 km². Department of La Paz occupies around 10 %, 130,295 km². Total area of the Omasuyos and Los Andes provinces is 2,065 km² and 1,658 km², respectively.

The population of Bolivia in 1995 is estimated at about 7.41 million and the annual growth rate is 2.41 % during the 1990 to 1995. Population in La Paz Department is at about 2.17 million. Economically active population is counted at 2.53 million for whole nation as well as 0.76 million for La Paz Department. The population density is estimated at about 6.8 persons/km² in the entire country, while 14.6 persons/km², 35.7 persons/km² and 37.5 persons/km² are the Department of La Paz, Omasuyos and Los Andes Provinces, respectively.

(2) Society

According to Mapa de Pobreza 1995, 37% of the households in the country are considered as extremely poor, 33% are as poor, and 30% are as non-poor. It is indicated that there is a significant gap between the urban and rural areas of the country. In the urban area, 13% of the households are extremely poor, 38% are poor, and 49% are non-poor. On the other hand, in the rural area 68% are extremely poor, 26% are poor, and only 6% are non-poor. The data of the Department of La Paz shows the similar characteristics. 39% of the households in La Paz are extremely poor, and 30% are non-poor. In the urban area, 17% are extremely poor, 38% are poor, and 45% are non-poor, while in the rural area, 74% are extremely poor, 22% are poor, and only 4.5 % are non-poor.

(3) Economy

GDP in the recent years is as follows:

	Unit	1992	1993	1994	1995	1996
GDP*1	bn.Bs.	20.5	23.0	26.0	29.7	33.9
GDP growth*2	%	2.8	4.1	5.0	3.7	3.6
Population	mil.	6.92	7.07	7.24	7.40	7.57

source: INE, *1 at market price; *2 real, agricultural sector-1996: 3.3%.

Trade had been liberalized and state enterprises had been privatized in spite of strong opposition.

Inflation rate in recent years is as follows. Thanks to the restrictive monetary policy inflation rate has been gone down; year-end inflation rate of 1996 was 7.9% on the previous year-end, the monthly rate since Sep. 1996 to May 1997 had been below 1%.

	Unit	1992	1993	1994	1995	1996
Inflation	%	12.1	9.4	7.9	10.2	12.5

Source: IMP

Recent balance of international payments are as follows. Increase in the import is the major cause of increase in the current account deficit.

	Unit	1992	1993	1994	1995	1996
Export*1	mil.US\$	608	716	985	1,042	1,174
Import*2	mil.US\$	1,041	1,112	1,122	1,385	1,567
Current Account	mil.US\$	- 534	- 506	- 218	- 413	- 431
Reserve*3	mil.US\$	182	223	451	660	955
External Debt	mil.US\$	4,223	4,220	4,749	5,193	5,013*4

*1: FOB, *2: CIF, *3: excluding gold, *4: provisional. Source: BancoCentral.

6 Present Conditions of the Study Area

(1) General

The Study Area belongs to Omasuyos and Los Andes Provinces in the Department of La Paz. Achacachi City, located in the north-west of the Study area, is the capital of Omasuyos Province, being the center of administration and economic activities. It is at the distance of 80 km from La Paz, the capital of the country. There are 30 communities and Achacachi City in the Study Area. Taking the present issues in the Study area and regional characteristics of development requirements into account, the Study area is broadly divided into three zones along with the Rio Keka namely, upper, middle and lower basins based on the natural and social conditions, administrative boundary and present farm management. On the other hand, in view of present economic activities in the Study area, upper basin belongs to the Battallas and La Paz economic bloc, though middle and lower basins belong to the economic bloc centralized Achacachi city areas. These situations were formed by complex of administrative boundaries, conditions of location, historical process of formation of villages and lack of road network in the Study area.

(2) Meteorology

The Study area belongs to the subtropical high land climate. The distinction of the rainy and the dry seasons is clear, and most of the annual precipitation is concentrated in the rainy season, and the days of the low temperature and high humidity last throughout the dry season. Average meteorological parameters in the Study area are summarized below:

-Mean annual rainfall	590	mm
-Annual mean temperature	7.1	°C
-Average maximum temperature	14.6	°C
-Average minimum temperature	-0.4	°C
-Annual mean relative humidity	65.8	%
-Mean wind velocity	12.8	km/hr
-Average annual sunshine hours	2,859.4	hr
-Mean annual evaporation	1,434	mm
-Annual mean frost days	170	days
-Annual mean hailstorm days	4	days

(3) Hydrology

The Study area extends along with the Rio Keka which has 3 tributaries within the Study area namely Rio Corpa, Rio Japa Jahuira and Rio Chiar Jokho from the upper reaches of the river course. Due to the infiltration of flow to the riverbed, springs can be seen in middle reach of the river course of the Rio Keka. During the dry season, no water flow can be seen in the Rio Corpa and the Rio Japa Jahuira due to irrigation water utilization in the upper stream reaches and infiltration of flow to the riverbed. A time series of monthly mean discharge at the Achacachi gauging station and at major diversion sites for irrigation of Rio Keka were estimated as follows on the basis of discharge data at the Achacachi gauging station taking the runoff from the spring and intake volume at the major diversion sites into consideration.

(Unit : MCM)

Station	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Achacachi	26.90	33.47	29.34	18.65	8.76	4.11	2.12	1.62	1.58	2.96	7.43	19.35	156.30
Upper reach (C.Alta)	22.71	28.49	24.76	15.66	7.25	3.40	1.71	1.53	1.50	2.56	6.28	16.32	132.16
Middle reach (Putuni)	22.66	28.64	24.75	15.31	6.78	2.91	1.19	1.01	0.99	2.04	5.82	15.97	128.05
Lower reach (Belen)	22.38	28.38	24.47	15.03	6.50	2.64	0.91	0.73	0.72	1.75	5.55	15.69	124.75

(4) Soils

The soils in the upper basin are superficial with a single horizon 0 - 20 cm of middle texture, being shaped by gravel and stones in deeper horizon. They have low capacity of humidity retention. Excessive drained, the contents of exchangeable Ca and Mg varies from Low to Moderate, the Na from moderate to High, cation exchange in K from Low to Moderate. The general characteristics of the soils of the middle basin are similar to those of upper basin area. The soils of lower basin correspond to flat topography. They are moderately developed and moderately deep, with clayey fine to silty fine texture, having dark gray color at superficial layers and some mottles at deeper horizons. These are good retention humidity soils. The general chemical characteristics are neutral reaction to strong alkaline, showing pH 6.7 in the arable layer, and pH 9.0 in the depth of 50 - 64 cm.

(5) Land Use

Total agricultural land in the Study area is estimated at 6,585 ha. Out of which 5,346 ha is upland field, 1,239 ha for glass land. Summaries are as follows.

Category	Upper Basin	Middle Basin	Lower Basin	Total
River	105.5	449.8	47.4	602.7
Residence, Roads	367.4	445.5	361.0	1,182.9
Grass Land	368.7	812.6	57.5	1,238.8
Upland Field	857.4	2,786.1	1,702.1	5,345.6
Total	1,708.0	4,494.0	2,168.0	8,370.0

(6) Administration and Population

Bolivia consists of nine departmental prefecture. There are two intermediate levels of regional administration, a province and a district, between a prefecture and municipalities or communities. A province is governed by sub-prefect, and a district is governed by corregidor. The Departmental Prefecture of La Paz consists of 19 provinces, in which nine are on the high plateau. Study area ranges between Omasuyos Province and Los Andes Province. 21 out of the total 31 communities are located in Achacachi district of Omasuyos province, six in Huarina district (Omasuyos province), two in Villa Asuncion de Corpaputo district (Omasuyos province), and one each in Villa San Juan de Chachacomani districts and Kerani districts of Los Andes province. The population and the number of families in the Study area are 36,790 and 6,610, respectively. Out of total population, 98% is Aymaras. The rest 2% consists of the Quechuas, mestizo and etc.

(7) Community

A "community" used to be a social organization that was a territorially localized with several or more groups of the different clans, through which its members conducted most of their daily lives and dealt with most of their common problems. The members were closely interrelated within a community and shared the common services such as school, hospital, means of transportation, etc. The members were expected to fulfill their respective roles to achieve their common goals in their unity.

By the Agrarian Reform Law in 1953, the traditional communities were legally acknowledged and assured their existence, the function as social organization remaining

the same. The communities were, by the Law, authorized their roles to represent officially the common interests of the members through their representatives. In 1994, the Participation Popular Law conceded the legal right to the communities. The Aymara's traditional communities then became the lowest administrative entity, *organizacion territorial de base (OTB)*. A coordinator, as a representative of the community, is to be placed at each OTB to supervise the public works implemented by the relevant municipality. The communities are also expected to plan and propose the works for their own development. In addition, the Decentralization Law was issued in 1995 to transfer many of the functions of the central government to the departments and lower administrative organizations. Accordingly, the communities are at present allocated to the budget to promote their own development activities, which are subject to the approval from the municipal authorities. It is pointed out, however, the capacity of the communities still needs to be improved to be able to manage those activities.

(8) Land Tenure

With the establishment of the Agrarian Reform Law in 1953, farmers, including the landless and small holders, were given the ownership of land, on the condition that the land is used for cultivation. The sizes of land holding per family currently range from 28 ha to 0, according to the survey result by the local consultant. The majority of people, however, own less than 3 ha. If people do not possess any land, they work on the others' land as tenants or borrow the land. The Inla Law, the new land law, was promulgated in October 1996 by the government. This Law comprises legislation to improve the land tenure and tilling systems and the creation of a national agrarian reform institute to be responsible for such tasks.

(9) Agriculture

Traditional farming which is the typical farming in the Study area is remarked as a farming for self-consuming by crops cultivation mixed with animal husbandry. Self-consuming products are milk, cheese and mutton, as well as crops such as potato, broad bean, Quinoa and vegetables.

The staple food of Potato and the forage crops of Barley and Oats are cultivated in all of the study area. Broad bean, Onion, vegetable crops, and Alfalfa can be seen mainly in lower and lower middle basin. While, secondary food crops such as Quinoa, Oca etc. are mainly cultivated in upper and upper middle basins. Annual consumption of potato counts 800-1,000 kg by one family with five members, however, this amount decreases with other self-consuming of grains or milk and cheese, then the actual self-consumption of potato is estimated at 600-700 kg per family. Required extent in potato cultivation for self-consuming is estimated at 0.3-0.4 ha in upper basin, and 0.2 ha in lower basin. Quinoa in upper basin and broad bean in lower basin are the secondary food crops for self-consuming. Self-consumption of livestock produce can be seen in mutton by 2-4 heads/year per family, with a little more in upper side (dead one is mostly used for self-consuming). Besides, cheese and fresh milk are consumed for themselves by 400-500 kg/year of milk per family, including the calf feeding.

Cropping calendar is as follows;

Crops	Seeding	Harvesting
Potato(irrigation)	Sep.- Oct.	Feb. - Mar.
Potato(non irrigation)	Aug. - Sep.	Feb. - Mar.
Broad bean	Jul. - Sep.	Mar. - Apr.
Quinoa	Jul.(end)-Aug.(end)	Mar. - Apr.
Onion(irrigation)	Jul. - Sep.(transplant)	Nov.(end)-Dec.(end)
Barley	Sep. - Oct.	Mar. - Apr.
Oats	Oct. - Nov.	Apr. - May
Alfalfa	Oct. - Nov.	(1) Jan.(end), (2) Mar.,

In the upper basin, alfalfa cultivation is not composed in their rotations. Broad bean cultivation is also very few, then, the rotation is mostly considered for the root crops (Potato, Oca) and the grain crops (Barley, Oats, and Quinoa.), showing 75% of all. In the middle basin, Broad bean is usually cultivated prior to Potato or Barley (grain crops). This pattern occupies 61%. Rotation of Barley and Potato shows 23%. In the lower basin, much more Alfalfa rotation(14%) can be seen than in the middle basin, Broad bean rotation shows 66%, and Barley-Potato rotation is only 20%.

The unit yield/ha in each crop is estimated as follows;

Crop	Unit yield / ha	Remarks
Potato	2,500 kg	Upper and Upper middle basin
	2,700 kg	Lower middle basin
	3,600 kg	Lower basin
	5,000 kg	Cash crop farms
Broad bean	720 kg	Dry beans
Onion	1,500 kg	With leaves
Quinoa	500 kg	Grain
Barley/Oats	2,000 kg	Hay
Alfalfa	2,500 kg	Green

Sheep and cattle are the major animals raised in the Study area. Llama and Alpaca are seen in the mountainous highland of the upper stream of the Study area. The serious problem on animal husbandry in the area could be summarized to a shortage of feed and poor quality and dwarf type of animals.

Land holding in the upper basin is 5 to 7 ha and raising 3 to 4 cattle and 20 to 30 sheep per farm, however, cultivated area is small as 1 ha. Upper middle basin in east of Cala Cala is similar climate condition as the upper basin and farming type also resemble.

In the lower middle basin in west of Avichaca, land hold is 2 to 4ha with animal raising of 4 to 6 cattle and 10 to 20 sheep. Dairy farmers are seen many. They are not able to maintain enough feed due to small land and naturally can not give enough nutrients. Due to malnutrition and poor quality of cow, 4 to 5kg per day at peak milk production and annual production is 600 to 700kg in short lactation period. There are many dairy farmers and milk selling is the base of agricultural income in the lower basin. In the peak of lactation period, milk production of one cow is 5 to 6kg per day. The lactation period is as short as 6 months and annual production is 700 to 800kg.

According to the major source of farming income, classes of farming types were considered as follows;

(ha / heads)	Type A	Type B	Type C	Type D	Type E	Type F
(a) Potato	0.4	0.4	0.3	0.4	0.3	0.2
(b) Broad bean	-	-	-	0.2	0.2	-
(c) Onion	-	-	-	0.05	-	0.05
(d) Vegetable	0.1	0.1	0.1	0.05	0.1	0.05
(e) Quinoa	0.1	0.1	0.1	0.1	-	-
(f) Barley(Oats)	0.8	0.6	0.2	0.4	0.4	0.1
(g) Alfalfa	-	0.1	-	0.1	0.1	0.1
(h) Grassland	2.2	1.7	0.8	1.5	1.3	0.1
(i) Sheep	18	13	12	7	3	1
(j) Cows	1.4	2.1	1.3	2.5	2.8	1.8
(k) Cattle	5.3	2.4	1.2	3.1	3.0	1.8

	Small size farms	Medium size farms	Large size farms
Upper basin	Type C	Type C	Type A
Upper-middle basin	Type C	Type B	Type B
Lower-middle basin	Type F	Type D	Type D
Lower basin	Type F	Type E	Type E

(10) Marketing

There are several intermediaries between producers and consumers. Producers sell their produce either to itinerant middlemen or directly to the rural markets, which further sell them to middlemen. Then the middlemen will sell their commodity to either the retailers in the urban markets or wholesalers, who in turn sell them to the retailers in the urban markets. Wholesalers are sometimes truckers. According to the study done by the SNAG in 1987, retailers of potatoes, for example, took 38.8 percent to the retail price in average as a commission, and wholesalers 11.6 percent, which left about a half to producers. Small farmers whose marketing channels have more intermediaries than big farmers have less share to hold. For rural consumers, there are either rural markets or rural retailers between producers and consumers. In rural markets barter system is available.

(11) Agricultural Support Services

Agricultural support services in the study area are generally not sufficient in order to promote rural and agricultural development. Especially an official institutional system of the support services are not practically functioned. However all the services provided in the study area was carried out by NGOs. The support of NGOs is provided to point to point, the systems of support services are applied by community base that organizations are approaching to individual community. Therefore the effect of support services has not been affected to the area. An agricultural research by the official organization in Altiplano is implemented by only two organizations. These are IBTA (Institute Boliviano de Tecnologia Agropecuaria) of La Paz department and the Belen Experiment Station of the UMSA (Universidad Mayor de San Andores). Belen experimental station has started some agricultural extension services recently by Social Interaction program.

Remarkable financial support for agriculture development by the official institution in the Study area is not seen except some private credit institution and NGOs' support associating with technical support projects.

Registered NGOs to the Sub-secretary of Public Investment and External Finances in Bolivia is 501 in 1996 and 247 NGOs out of 501 are carrying out activities in La Paz department. 98 NGOs in agriculture and livestock development, 14 in credit, 141 in education, 67 in environment and 98 in health are working. It is found that NGOs are conducting agriculture, forestation and livestock projects in the Study area. They had ever been implemented some other projects in the past as well. Vinyl house cultivation at 2 communities, community forestation at 4 communities and women's income generation at 1 community are carrying on at present.

(12) Irrigation and Drainage

Fifty five (55) irrigation and drainage systems were identified in the Rio Keka basin, 32 systems in the main river course and 23 systems in the tributaries. Summaries of the systems are shown below.

Rio keka Basin	No. of Irrigation System	Commanding Area (ha)
Main Stream Course	32	3,958
Tributaries	23	2,698
Total	55	6,656

No clear drainage system can be seen in each irrigation system. Dual-purpose canal for irrigation and drainage is general manners especially in the downstream reach of irrigation systems.

All irrigation system in the Study area is constructed by the gravity irrigation method from the water source to each farm lots. To use the limited irrigation water equally among the beneficiaries, rotational irrigation method is widely diffused in each irrigation system. At the farm lot basis, furrow irrigation for crop cultivation is the prevailing irrigation method. Close to ponding irrigation method is also seen in the pasture land used under the natural conditions.

Since existing irrigation system in the Study area has been constructed by farmers themselves without consultation of technical background, Most of existing irrigation systems have problems such as incoherence between the available irrigation water and the related commanding area. As the results, no theoretical irrigation water use on the basis of the crop water requirement has been carried out conventionally. Irrigation water distribution by simplified time schedule among the concerned farmers is being prevailed.

Water users group in the Study area is constructed in community basis. As the chief of water users group, Alcalde Agua is nominated with the consent of the community members. Alcalde Agua has responsible for all O & M works of commanding irrigation canals. During the dry season, irrigation water distribution is made with rotation method to attempt equal distribution among the water users. Alcalde Agua decides the time and duration of rotation within the commanding canals. When commanding canals locate downstream reach of the other Alcalde Agua's commanding canal system, adjustment of water distribution will be carried out with related Alcalde de Agua to secure the water for the community.

(13) Rural Infrastructure

The present conditions of each community are summarized as follows:

Comunidad	Education	Health Care	Water Supply	Electricity	Meeting	Transportation	Road
Kerani	4	2	4	2	2	4	2
Chachacomani	4	2	1	1	1	3	1
Corpaputu	3	1	1	1	1	2	1
Coromata Alta	4	1	2	2	2	3	1
Coromata Media	2	1	2	2	2	3	1
Coromata Baja	2	1	2	2	2	1	1
Berenguela	2	1	1	1	2	1	2
Pongon Huyo	4	1	1	2	1	2	1
Pairumani	2	1	4	1	1	1	1
Icrana	2	1	4	3	1	3	2
Pajchani Grande	3	1	3	1	1	3	2
Pajchani Molino	3	1	3	3	1	2	2
Cala Cala	3	1	5	2	1	3	1
Barco Cala Cala	2	1	5	2	1	3	1
Jahuir Laca	2	1	1	3	2	4	2
Avichaca	3	1	5	3	1	4	2
Suntia Comun	1	1	3	3	2	1	2
Suntia Chico	1	1	3	3	2	1	2
Suntia Grande	2	1	3	1	1	2	2
Putuni	2	1	3	1	2	1	2
Marca Masaya	2	1	3	1	1	4	2
Kjasina	2	1	3	1	1	2	2
Tipampa	2	1	3	3	1	3	2
Cajon Pata	1	1	1	3	1	4	2
Taramaya	2	1	1	3	1	4	2
Arsaya Chico	1	1	3	3	2	3	2
Arasaya Kentuyo	1	1	3	3	2	3	2
Arasaya Patanivi	1	1	1	3	1	2	2
Belen	4	1	1	3	2	4	2
Barco Belen	2	1	1	3	1	3	1
Ciudad Achacachi	5	3	5	3	2	4	3

note: Education	5: E.Tecnica	4: Medio	3: Intermedio	2: Basico	1: No
Health care	4: Hospital	3: Dispensary	2: Health Center	1: No	
Water supply	5: Supply Sys.	4: Comuni. Tap	3: Manual Pump	2: Under Con.	1: No
Electricity	3: Electricity	2: Under Con.	1: No		
Meting Cent.	2: Existing	1: No			
Transportation.	4: Frequently	3: Daily	2: Week	1: No	
Road	3: Enough	2: Not enough	1: Bad		

The upper basin is dividing into two parts by Rio Keka. During the rainy season, the traffic is cut off due to the flood of Rio Keka. The middle basin is also dividing into two parts by Rio Keka. Trunk roads were constructed on both banks of Rio Keka, however, damages of road surface are serious and requires urgent improvement. Moreover, no facilities to manage the health of inhabitant are installed in the area and provision of drinking water supply facilities is delayed. The lower zone is located in the extreme lower reaches of Rio Keka and Achacachi City belongs in this zone. Fundamental infrastructure are comparatively fixed because the area locates suburbs of the Achacachi city.

(14) Environment

Ministry of Sustainable Development and Planning (Ministerio de Desarrollo Sostenible y Planificación) superintends a environmental department. The Ministry is the organization for all matters concerned harmonious national development, human resources, quality of environment and restoration and maintenance of natural environment and national economy. The Ministry consists of six vice-ministry i.e., Planning and Land Demarcation, Sustainable Development and Environment, Populace Participation and Fortification of Municipality, Gender/Generation and Family Issues, Indigenous and Aborigines Issue, Protection Area.

Laws concerned environment is the law of environment. The law of environment (Ley General del Medio Ambiente, DL1333 del 27/4/1992) contains the enactment of the standards and principles concerning the organization of environment and the protection and environmental control. This law is placed in the center of domestic related to the environment. The law consists of each regulation, environment control, environment conservation, air pollution material, water pollution material, radioactive dangerous object. It is made decides the general guide line of making, application and interpretation of a policy, law and regulation about the protection, conservation, exploitation and control of the natural resources.

Regarding environment impact assessment, it is prescribed in the Article 25 of the law of environment that all works and activities by any public and private body is decides the category of the environment impact assessment before the investment is carried out. The four categories are as follows.

- Category I : Needs comprehensive EIA.
- Category II : Needs specific EIA
- Category III : Desirable to do conceptual examination though specific EIA is not necessary
- Category IV : No need any EIA.

It is required that environment investigation sheet (Ficha Ambiental) is made in all projects and submitted to the National Secretary of Natural Resources and Environment. The investigation to make FA is equivalent to the initial environment evaluation (IEE). The National Secretary of Natural Resources and Environment decides whether environmental impact assessment should be executed or not according to the content of FA.

The law of hunting and fishery of wildlife in national parks rules four protection area mentioned below. Each protection area is not included in the study area.

- National park
- Evacuation area for wildlife
- Protection area for wildlife
- Sanctuary for wildlife

When thinking about an environmental problem in an agricultural development of the Rio Keka basin, it is necessary to consider the water quality conservation of the Titicaca Lake to which Rio Keka is flowing in the final ahead. As for the water pollution in the Titicaca Lake, pollution around the Puno city and the Juliaca city which are located the Peruvian side is notable. Discharge from houses attributes to this pollution rather than that from agriculture and from Gold Mine Mountain.

7 Constraints and Potentials

Through the field study, following development constraints is identified;

- Poor soils and marginal land use, severe meteorological conditions for crop cultivation, unsettled river course, remarkable change of river runoff between rainy and dry seasons, incoherence between available irrigation water and commanding area.
- Lack of irrigation and drainage facilities, non-establishment of the road networks, insufficient drinking water supply facilities, defective means of electric supply facility, lack of health and medical facilities, inadequacy of the maintenance of educational facilities, lack of the meeting facility.
- Gap between subsistence economic society and market economic society, lack of assistance for difficulties, lack of access to economic and social infrastructures, lack of agricultural support service system, immature marketing system on agricultural products.
- Traditional farming system, minimized land, lack of information and knowledge.

Following is also identified as the development potentials in the Study area.

- Existence of irrigation system and O & M structure of each canal system,
- Existence of well-established community organization,
- Existence of advanced farmers in the Study area,
- Existence of marketing organization on dairy product,
- Possibility of expansion of water use during the rainy season,
- Technical and financial supports through public and private organizations,
- Possibility on effective use of communal land, and
- Inland fish cultivation

8 Basic Concept of the Development Plan

The purpose of the Study is to alleviate the poverty situation, i.e. i) to contrive sufficiency of settlement condition and amelioration of farm household economy by promotion of regional agricultural production, ii) activation of regional economy and facilitation of farmers' settlement by promotion of agricultural production surrounding areas of intermediate cities expressed in the "Regional Agricultural Development Program joint to Intermediate Cities (PRODARCI)" which is the precedence political program of the Study.

With these present situation of the Study area and the purpose of the Study, development concept of the Study can be summarized, 1) Amelioration of farm management, improvement of agricultural infrastructure and establishment of agricultural support system to promote agriculture in the Study area, and 2) Improvement of socio-economical infrastructure to contribute the establishment of economic bloc in the Rio Keka basin as a whole.

Present farm management in the Study area is practiced by the traditional mixed farming consisting the self-sustaining crop cultivation and the livestock raising as the basic means. Much weight is given to the commodity production either crop farming or livestock raising based on the natural conditions such as climate and available water in the upper, middle and lower basins. The envisaged agricultural development plans will be emphasized for the increase of commodity production to elevate the farmer's income by amelioration of present farm management with the appropriate agricultural support services. Furthermore, PRODARCI which is the precedence policy of the Study intends to regulate the migratory flows from rural areas to large cities, facilities to contribute the establishment and/or activation of regional economic bloc centering the Achacachi municipal areas will be given the priority in the infrastructure development of rural facilities in the Study area.

Since proposed components to be improved through the Study cover various fields and numbers, it is proposed that the stage wise implementation strategy such as the short, middle and long term development. The terms of short, middle and long will be assumed by 5 years.

9 Agricultural Development Plan of Achacachi Area

(1) Land and water Resources Development

Objective areas of the Study were concluded at 8,370 ha taking the area boundary shown in the Scope of Work and the topographic map of scale 1 to 5,000 compiled through the Study. Out of the total Study area, presently used for farm lands including fallow and grass lands are demarcated at about 6,580 ha. in gross. Other land use in the study area such as roads, rivers, residential areas, etc. is estimated at about 1,790 ha. The development potential of agricultural land in the Study area is assessed with land capability classification based on the results of soils, land use and crop suitability survey. With these survey results, no land to be capable for new areas of agricultural land reclamation can be recognized. However, for the communal land of each community used as a pasture land under the natural conditions, efficient land use will be considered to increase grass production and cutting feed. Also, intensive agricultural land use will inevitably be the basic development strategies on agriculture from the available land resources in the Study area.

The Study area is located in the Rio Keka basin. Around 670 mm of annual average basin precipitation generates around 156.0 MCM of annual average runoff at the Achacachi observatory in the Study area. Only 12.4 MCM flow is available during the drought from June to October, of which monthly average runoff shows about 1.6 MCM in August and September. As for the low-water year with probability on return period of 5 years, runoff at the Achacachi observatory comes 87.7 MCM annually and 5.9 MCM during the drought from June to October.

Fifty-five irrigation systems with total net irrigation area of around 5,700 ha are now utilized surface flow of Rio Keka main stream and its tributaries. Most of the existing irrigation systems utilized river surface flow during the wet season mainly from November to May. From the theoretical peak water requirements of crop (2,500 m³/month) and average runoff of Rio Keka, irrigable areas by river surface flow can be estimated theoretically at 640 ha in August and at 13,400 ha in February as well as 25,000 ha annually. With these facts, the Study area has the potentials to irrigate all existing irrigation systems through the year when the annual runoff of Rio Keka can regulate by appropriate facilities such as reservoir. New water source development is not proposed in view of the required cost for new water source development and the economic viability of the development plan derived from the Study. Expansion of irrigation water use is, therefore, devised through effective use of presently available water mainly runoff of the Rio Keka.

(2) Agricultural Development Plan

Amelioration measures of present farm management will be constructed taking the natural conditions on upper, middle and lower basins, marketability of the products, existing agricultural resource, efficiency of present farm management into account. The basic development approach of each basin is as follows;

Upper to upper middle basins

Crop cultivation in the upper basin are limited to self-consuming and forage crops due to poor soil and severe climatic conditions. Major agricultural income depends entirely on sheep and draft cattle produce using the private and/or public natural grass land. Major items to be developed are the increase of number of heads on sheep by improvement of natural grass land, and conversion from poor quality draft cattle raising to sheep raising.

Lower to lower middle basins

Agriculture in the lower to lower middle basins is characterized dairy farming and cash crop cultivation. Most of the farmers engage in dairy farming, however, farmers who cultivate cash crops such as onion and vegetables are omnipresence according to the soils and irrigation conditions. Agricultural development in these areas aims to increase of milk production based on the improvement of dairy breed by artificial insemination. Promotion of cash crop cultivation on small-scale farmers will also be planned through effective utilization of irrigation and green houses.

Major technical aspects to realize the above mentioned are as follows;

- 1) Solution of feed shortage
 - 1) Enlarge of forage crop land; Improvement of natural pasture
 - 2) Supplementary feed of concentrate according to the necessity
- 2) Improvement of animal quality
 - 1) Maintaining of qualified bull in the area
 - 2) Practicing of artificial insemination
 - 3) Eliminating of poor quality animals
- 3) Improvement of livestock management system
 - 1) Effective feed planning in dry season
 - 2) Cattle protection from cold weather at night
- 4) Effective use of irrigation water
 - 1) Stable cultivation of cash crops such as Onion, Broad bean, etc.
 - 2) Round year cropping in green house
 - 3) Extension of perennial grasses such as Alfalfa
- 5) Improvement of material and produce marketing by community co-operatives
 - 1) Introduction of community co-operatives (association)

Because careful attention is paid to the traditional farming system and no drastic changes of present farming system is expected in the proposed agricultural development plan, both introduction of new farming technique and its results derived from the assistance by proposed agricultural assistance program

Land use and animal holding on the average in each farming development type is summarized for the types at present. In these classification, Type D and E at present are grouped in Dairy type, and Cash crop type is represented by Type F at present.

Farm planning type	Sheep Dev. Type			Dairy Dev. Type			Cash Crop Dev. Type		
Farm type at present	Type A, B, and C			Type D and E			Type F		
Basin	Upper and Upper middle)			Lower and lower middle					
	Present	(1)	(2)	Present	(1)	(2)	Present	(1)	(2)
(a) Food crops extent (ha)	0.6	0.6	0.6	0.7	0.6	0.6	0.3	0.3	0.3
(b) Forage crops extent (ha)	0.6	0.8	0.8	0.5	0.8	0.8	0.2	0.35	0.35
(c) Waste land / Fallow (ha)	1.0	1.0	1.0	0.1	0.1	0.1	-	-	-
(d) Grassland * (ha)	1.5	0.6	-	1.4	0.9	0.4	0.1	-	-
(e) Improved Grassland (ha)	-	0.7	1.3	-	0.3	0.8	-	-	-
(f) Heads of Sheep	14.5	32.0	38.0	4.6	4.6	4.6	1.0	1.0	1.0
(g) Heads of Cows	1.6	1.6	1.6	2.7	2.7	2.7	1.8	1.8	1.8
(g) Heads of draft (beef) Cattle	2.5	1.7	1.2	3.0	2.5	2.0	1.8	1.3	1.3

* Grassland in Sheep type is natural grassland with "Stipa", gravel or wet land.
Grassland in Dairy type and Cash crop type is improved sown pasture.
(1) : 5 years later, (2) : 10 and 15 years later

The anticipated yields are listed as follows.

< Anticipated Yield >	unit	at present	5 yr. later	10 yr. later	15 yr. later
Potato(Upper/U-	kg/ha	2,500	2,700	3,000	3,000
Potato(lower-middle)	kg/ha	2,700	3,000	3,300	3,300
Potato(lower basin)	kg/ha	3,600	4,000	4,400	4,400
Potato(cash crop farms)	kg/ha	5,000	7,000	7,700	7,700
Broad bean	kg/ha	700	750	800	800
Onion	kg/ha	15,000	16,000	17,000	17,000
Quinua	kg/ha	500	550	600	600
Barley(Oats)	kg/ha	2,000	2,200	2,500	2,500
Alfalfa	kg/ha	2,500	3,000	3,500	3,500
Improved/Intensive	kg/ha	-	5,000	5,000	5,000

Indicators of the improvement plan on livestock farming are shown below.

Development indications on sheep

	Unit	At present	5 years	10 years	15 years
a) Live weight/male	Kg	30	40	50	50
b) Live weight/female	Kg	25	30	40	40
c) Breeding age	Month	20	18	18	18
d) Maternity age	Month	25	23	23	23
e) Birth rate/adult sheep	%	60	80	90	90
f) Procreative age	Year	4	5	6	6
g) No. of lamb prod./sheep	No.	2	4	5	5
h) Mortality rate/adult	%	5	3	2	2
i) Mortality rate/lamb	%	25	20	10	10
j) Wool prod./yr./head	Kg*	2.5	4.0	5.0	5.0

Note: * Row wool not washed

Development indications on dairy cow

	Unit	At present	5 years	10 years	15 years
a) Live weight of cow	Kg	350	400	450	500
b) Breeding age	Month	26	24	22	22
c) Maternity age	Month	38	36	34	34
d) Birth rate/adult cow	%	65	75	80	80
e) Procreative age	Year	6	8	8	8
f) No. of calf prod./sheep	No.	3	5	5	5
g) Mortality rate/adult	%	5	3	2	2
h) Mortality rate/calf	%	40	20	15	10
i) Milk prod./yr./head	Liter	700	900	1200	1500

Farm budget and income plan in each type is calculated as follows.

Farm planning type	Sheep Dev. Type				Dairy Dev. Type				Cash Crop Dev. Type			
Farm type at present	Type A · B · C				Type D · E · F				Type F ²			
	Present	(1)	(2)	(3)	Present	(1)	(2)	(3)	Present	(1)	(2)	(3)
(a) Cash outlay Bs	477	1,176	1,402	1,513	821	3,294	1,756	1,960	524	993	1,284	1,441
(b) Gross income Bs	3,838	6,534	8,781	9,249	4,579	5,699	6,590	7,265	3,006	4,363	4,972	5,417
(c) Net income Bs	3,361	5,358	7,379	7,736	3,758	4,405	4,834	5,305	2,482	3,370	3,688	3,976

(1) : 5 years later, (2) : 10 years later, (3) : 15 years later

Production increment in the Study area is as follows;

<Crop Production>

	Present	5 years later	10 years later	15 years later
a) Potato (Self-consuming farms)	1,740 t	1,680 t	1,848 t	1,848 t
(Cash crop type farm)	900 t	1,260 t	1,386 t	1,386 t
b) Broad bean	156 t	167 t	178 t	178 t
c) Onion	720 t	1,075 t	1,142 t	1,142 t
d) Lettuce	80 t	88 t	96 t	96 t
e) Quinoa	-	51 t	51 t	51 t
f) Barley(Oats)	2,158 t	3,388 t	3,795 t	3,795 t
g) Alfalfa	553 t	1,491 t	1,740 t	1,740 t
h) Grass	-	6,680 t	12,520 t	12,520 t
Total	6,307 t	15,832 t	22,756 t	22,756 t

<Livestock Production>

	Present	5 years later	10 years later	15 years later
a) Heads of Sheep	24,330	42,890	51,670	51,670
b) Heads of Dairy Cow	5,970	5,970	5,970	5,970
c) Heads of Draft Cattle	7,280	5,613	4,674	4,674
d) Seep Production (sale & consuming)	6,952	24,018	33,069	33,069
e) Milk production (-do-)	1,800	3,010	4,011	5,015
f) Sale of Calves	776	1,737	1,910	2,090
g) Sale of Old Cattle (including consuming)	2,292	1,954	1,830	1,830
h) Sale of Wool (kg)	0	34,313	77,500	103,340

(3) Farmers' Organization and Agricultural Support System Development Plan

Proposed agricultural development plan is the means to improve farm household economy and it needs technical and financial support on its implementation. However it is not able to consider practical involvement of official support services in the present Bolivian situation. The supports in the project area are carried on by only NGOs, which are approaching to a spot base. The plan of improvement of farming is formulated based on farming pattern of the upper, middle and lower basins of Rio Keka according to agricultural conditions in the project and a method of accept NGO's support by a base of extended area will be effective and efficient. Therefore, a receptors organization across communities is indispensable as a basic factor for agricultural support services.

Agricultural development plan is also backed by hardware facility as agricultural and rural infrastructure. These facilities are to be improved in the extended area across communities and the similar type of receptors organization will be required for operation and management of the equipment provided for maintenance of the facilities.

A base facility is proposed as core organ of receptor organization in order to utilize and manage equipment provided for maintenance facilities of both agricultural and rural infrastructure. This base facility is named "Community Re-vitalization Center (CRC)" in the project.

CRC is introduced as the base for providing the support system for all

beneficiaries in the Study area and for carrying out the support services effectively in order to achieve the objectives of the Study. Background of an idea on CRC and its function are to contribute for fostering farmers and communities toward positive attitude and self-reliant, acquired farmer of reliable production and management technique and knowledge and socially and economically active women. Following functions will be essential, the function will be changed and applied by steps according to the situation and priority of needs of the area;

- i) Extension of production technique on agriculture and livestock
- ii) Improvement of farming and other economical activity
- iii) Dissemination of skill and knowledge for creating comfortable rural life
- iv) Management and maintenance of social and economical infrastructure of the area
- v) Providing the place for medical and health care services
- vi) The place of communication for community and residents in the area
- vii) The place of social and cultural activities for community and residents in the area.

The CRC should have facilities for meeting, classroom training, practical training and exercise, storage for equipment and farm products, demonstration plot, medical care space and others necessary to implement center's functions. Equipment are for maintain social and economical infrastructure, farming aid, training, artificial insemination and administration.

Since community in the area traditionally has their own system of administration and management, operation and management of the CRC should be handled by the communities and residents of the concerned area. The concept, the purpose, the functions and the operation and management etc. regarding the CRC may not be familiar for the people in the area. It is desirable to support their activity at initial stage. Two types of support can be considered, one is operation and management of the CRC and the other is technical and financial for solving problem of the area. The support for operation and management of the CRC should be responsible by the coordination organ of the official institution of the project implementation.

Development of facility and equipment regarding the center is planned according to the steps as the short, middle and long terms considering necessary fund and the effect of the project activities. In the short term, accumulation of social and economical infrastructure, and improvement of the present agriculture and livestock in the project area are to be emphasized. Related priority facility and equipment with the development plan are O & M machinery for the infrastructure and its garage, and the demonstration plot for improvement and promotion of agriculture and livestock. Agricultural support concerning the substantial contents of activity and establishment of the center's organization will be started at the beginning of the project. However, the activities as meeting and training are to be carried out by using the center's space and school in the area.

In the middle term, main building for the meeting, training and management, and necessary equipment which are going to increase the necessity according to progress of the activity, will be developed for fulfilling the center's facility and function. The facility development will be completed by fencing of the center in the long term.

	CRC			AC			MH		
	short	middle	long	short	middle	long	short	middle	long
Main building	-	3	-	-	6	-	-	5	10
Garage	3	-	-	3	3	-	-	-	-
Green House	-	3	-	-	-	-	-	-	-
Demonstration Plot	3	-	-	-	-	-	-	-	-

unit:place

(4) Agricultural Infrastructure Development Plan

Three stages such as short, middle and long terms are considered for implementation of the agricultural infrastructure development. Since objective areas of the Study have been settled at around 8,400 ha, the existing irrigation systems located at the out of the objective areas will be categorized in the long term stage improvement. Concerning the irrigation systems located within the Study area, selection for the short term or middle term stages improvement is made with the following criteria;

- availability of water utilization during the dry season
- scale of the commanding irrigation area
- degree of the contribution for the improvement of farm management
- number of the related communities
- degree of the effects for water saving

Based on the above criteria, priority among the existing irrigation systems are evaluated by using matrix table. The five (5) irrigation systems are selected as the short term stage improvement systems and others are set up as the middle term stage improvement. Selected systems are shown in same Table. Summaries of the stage wise improvement systems are as follows;

Stage	Nos. of Irrigation Systems	Gross Irrigation area (ha)	Net Irrigation area (ha)
Short Term	5	1,979	1,789
Middle Term	27	2,102	1,683
Long Term	23	2,575	2,190
Total	55	6,656	5,662

Based on the present land tenure and cultivated crops, a classification of farming type has been made through the analysis of present farm management in the Study area. Unit diversion water requirement of each farming type is estimated as follows to settle the system capacity of the irrigation facilities.

Farming Pattern	Unit Diversion Requirement (mm/ha)	Maximum Water requirement (l/sec/ha)
Type A, (Upper basin)	653	0.53
Type B, (Middle basin)	749	0.54
Type C, (Middle basin)	724	0.55
Type D, (Lower basin)	820	0.57
Type E, (Lower Basin)	840	0.56
Type F, (Middle basin)	1,007	0.61

Present lateral intake structure with training levee method is followed as the intake structures of canals in the improvement plan. Proposed intake structure consists of training levee and inlet portion. Main and a part of secondary canals are designed as masonry lining to prevent much water losses from the canal reaches. Basically, no modification of existing canal route is planned in the design. Canal length of each implementation stage are as follows;

Stage	Nos of Systems	Canal Length (km)	
		Main	Secondary
Short Term	5	57.3	11.4
Middle Term	27	60.3	13.3
Long Term	23	59.1	10.0

O & M road are designed to provide along main and secondary canals when no road is provided in the existing main and irrigation canals. Division structures from the main to secondary canals and canals to each farm lots will be designed to avoid excess water use and losses at the division points. Gate will be equipped at the division points. Crossing structures of canals and/or canal itself will also be designed to cross the roads and streams.

To supplement the irrigation water, reservoir on the way of irrigation canals will be designed as much as possible. Basically, dam body for reservoir will be designed as the combined structure with road or canal bank. Fish cultivation is also planned in those proposed reservoirs. Through the field survey, following three (3) sites were confirmed as the possible site for reservoirs;

Irrigation System No.	Location	Dam Body		Reservoir Capacity (m ³)
		Height (m)	Length (m)	
9	Putuni	2.5	700	140,000
12	Pajchani Molino	2.5	300	60,000
16	Icrana	4.0	350	115,000

Based on the available river flow and required diversion water requirement in the Study area, irrigation area increase by canal improvement is estimated theoretically with the condition that non-exceedance probability is 1 to 5 years. Summaries by implementation stage-wise are as follows.

	No. of Irrigation System	Total net Irrigation Area (ha)	Irrigable Area (ha)					
			Without Improvement		With Improvement		Incremental Area	
			Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
Short Term	5	1,683	775.9	241.1	884.4	310.2	108.5	69.0
Middle Term	27	1,789	815.1	245.9	965.6	315.8	150.5	70.0
Long Term	23	2,190	408.0	112.0	525.0	144.0	117.0	32.0
Total	55	5,662	1,999.0	599.0	2,375.0	770.0	376.0	171.0

All existing irrigation systems in the Study area have been constructed by the gravity irrigation method from the water source to the each farm lots. To use the irrigation water equally among the beneficiaries, rotational irrigation method is widely diffused in the existing systems. No change of prevailing water utilization method among the farmers and/or communities can be considered in the irrigation development plan of the Study taking into account the tradition and customary water right in the Study area. In order to proceed smooth and effective operation and maintenance of the irrigation facilities improved, activation of water users group in the community level and water users' association in the basin level is essential. Both organizations has been established and well being functioned in the Study area. Judging from the present activities of these water users group, new organization for water management is not proposed in the irrigation development plan.

(5) Rural Infrastructure Development Plan

Based on the situation of the existing facilities, improvement level of the rural area and the target of improvement will be set up. The process of improvement is divided into three stages as short, middle and long term developments. The level of improvement will be raised gradually by the development stages. The urgent need for agricultural development will be implemented at the short term development stage. After establishment of the improved agricultural production and organized activities of farmers in the study area, the plan classified into the middle and the long term developments will be implemented

To create the economic sphere of Rio Keka basin centralized Achacachi city, construction of the road network within a basin and improvement of existing roads are indispensable. Therefore the priority should be given to the trunk road improvement over the other infrastructures. The selection of roads to be improved will be decided taking the three major views such as relativity with the agricultural activities, effectiveness for the road network and executionability into account. Road improvement plan at each development stage is as follows;

Facility	Stage	Short term		Middle term		Long term	
		Route	km	Route	km	Route	km
Main road		2	56.8	-	-	-	-
Connection road		2	7.2	9	31.3	8	33.5
Village road / Farm Road		-	-	23	40.8	24	33.7
Related facility							
Bridge		1 place		-		-	
Submerged Bridge		6 places		6 places		2 places	
Culvert		81 places		91 places		91 places	

Agricultural extension center will be installed as a core facility for communication, agricultural and rural development in the area. The center is also function for operation and maintenance of the proposed rural infrastructures. Two levels of the center are considered to fulfill the objectives and covering the areas. The core center (CRC : Community Re-vitalization Center) is to be installed in representing location of agro-ecological area in the Study area and consists of i) main building for training and management (including meeting room, training room, medical care room, space for storage and shipping of the products), ii) demonstration farm (demonstration plot for technology transfer of farm management) and iii) garage for O & M machinery. The sub-center (AC : Area Center) is to be installed to supplement the core center for covering the respective area and consists of i) main building for meeting and storage and shipping of the products, and ii) garage for O & M machinery. Proposed numbers of facilities on each development stage are as follows;

Agro-ecological area	Community	CRC		AC	
		Short	Middle	Short	Middle
Upper basin	Chachacomani	Garage & Plot	Main building	-	-
	Kerani	-	-	Garage	Main building
	Cornata Baja	-	-	-	Main building & Garage
	Corpaputo	-	-	-	Main building & Garage
Middle basin	Cala Cala	Garage & Plot	Main building	-	-
	Putuni	-	-	Garage	Main building
	Jawir Laca	-	-	Garage	Main building
	Pongon Huyo	-	-	-	Main building & Garage
Lower basin	Belen	Garage & Plot	Main building	-	-

(6) Environmental Conservation Plan

Influence to be forecasted on environment by implementation of the project can be considered on the infrastructure improvement and the amelioration of present farming management. For the infrastructure improvement, it can be said that the plan has generally little influence on environment because the component of the plan is rehabilitation of existing facilities. In the amelioration of farming, grassland reclamation for forage crops and introduction of chemical fertilizer and agricultural chemicals are planned as the project measures. Grassland reclamation is not only important as the fodder production but also as the effect to prevent soil erosion aggravated by bare land. Regarding the impacts of introduction of chemical fertilizer and agricultural chemicals, farming guidance by experienced persons is planned at the Community Re-vitalization Center as a pivot. Therefore it is no problem as regards with the impacts on the environment because appropriate use of the fertilizer and agricultural chemicals is guided.

FA was made as an initial environmental evaluation and examined by National Secretary of Natural Resources and Environment (MDSMA). The result of examination of FA was finally approved category III. Based on the evaluation results of MDSMA, necessary items of consideration for making a countermeasure of environmental conservation in the future are the social environment, soil erosion and water quality conservation. As for the social environment, an agreement with the local inhabitant is necessary to establish the development plan. Because project formulation of the project is made with occasional participation of beneficiaries, mutual consent of the inhabitants

related to the project is thoroughly considered. In the present time, remarkable soil erosion is not seen in the study area. But, the study area is the area which has the possibility of the land devastation and the decline of the productivity due to the soil erosion from the viewpoint of the topography and the meteorology. Therefore, the examination is necessary in the formulation of the project.

Concerning the water quality conservation, detailed and careful consideration is necessary for planning an agricultural development plan in rivers that flow into the Titicaca Lake. However, the basin rate which the Rio Keka occupies in the Titicaca Lake basin is small and rainfall is also few. Moreover, as already described in the example of Puno City, sewage due to a population increase is the biggest cause in water pollution. This plan is not intended to settle the new migrant, but aims at promotion of settling down the native inhabitants in the project area as it was, therefore, there would be no anxiety for the water quality.

Mitigation measures on environmental impacts should be considered regarding air pollution, soil erosion, erosion of aggregate collection site, pollution from workers' camp, noise, boundary modification at the implementation stage, and water quality deterioration, alkalization and salinization of soil, soil erosion on farmland, social economy, problems of intakes and canals in the maintenance, possible change of ground water system for the management stage of the project.

Monitoring will be carried out for assessing the effectiveness of mitigating measures. It should be done over the entire life of the project. As was mentioned already, there is little anxiety concerning environmental impacts of the project that put stress on improvement of agricultural facilities at present. However, minimum monitor of water quality for preventing water pollution in the Titicaca Lake is desirable.

10 Organization of the Project Implementation and O & M

In Bolivia, Ministerio de Hacienda coordinates the financing from a foreign country of a project and the participation of authorities concerned to carry out the project at national level. The executing agency of the project will be the Department of La Paz under the supervision of Ministro de Agricultura, Ganadería y Desarrollo Rural. Dirección Desarrollo Económico, which is one of the departments in governmental organization of Department of La Paz, will give the administrative and technical support. Establishment of Coordination Organ in the project is recommended under the economical development bureau for effective management. Coordination Organ will coordinate the project with the government of Bolivia during the start of the project till the end of the construction works and work for supporting the operation of CRC after the construction works.

O & M of implemented facilities will be executed by each community as a basic unit under the decision of the Committee of CRC. In accordance with the policy of the government of Bolivia, implemented project facilities has to transfer from the executing agency to the beneficial farmers as soon as possible. Committee of the CRC. will succeed the implemented facilities from the executing agency after the management of CRC is started along the right lines.

11 Implementation Program and Project Cost

The project will be implemented with three stages; short, middle and long term stages. Each stage is assumed by 5 years and consists of detailed design, preparation of tender documents and tender procedure for one year, and construction period of one and half years. Construction costs are estimated at the price level as of June 1997 taking into consideration the updated costs of labor, construction materials and equipment. Civil engineering works will be executed by contractors on a contract basis. Construction cost of each development term is summarized below.

Short Term Development		Unit : US\$ 1,000		
Description	L/C	F/C	Total	
1 Construction Cost				
Preparatory Works	39.1	88.2	127.3	
Agricultural Infrastructure Development	883.1	2,059.3	2,942.4	
Rural Infrastructure Development	962.9	2,153.8	3,116.7	
Agricultural Support Service Facilities	106.5	198.3	304.8	
2 Land Acquisition	15.0	0.0	15.0	
3 Engineering and Administration	239.0	540.0	779.0	
4 Purchasing of O & M Machinery	442.1	821.1	1,263.2	
5 Physical Contingencies	199.2	450.0	649.2	
Grand Total	2,886.9	6,310.7	9,197.6	

Middle Term Development		Unit : US\$ 1,000		
Description	L/C	F/C	Total	
1 Construction Cost				
Preparatory Works	38.9	83.8	122.7	
Agricultural Infrastructure Development	1,006.8	2,347.2	3,354.0	
Rural Infrastructure Development	468.0	1,091.2	1,559.2	
Agricultural Support Service Facilities	469.6	753.0	1,222.6	
2 Land Acquisition	15.0	0.0	15.0	
3 Engineering and Administration	297.5	641.3	938.8	
4 Purchasing of O & M Machinery	6.1	11.3	17.4	
5 Physical Contingencies	198.3	427.5	625.8	
Grand Total	2,500.2	5,355.3	7,855.5	

Long Term Development		Unit : US\$ 1,000		
Description	L/C	F/C	Total	
1 Construction Cost				
Preparatory Works	25.5	57.4	82.9	
Agricultural Infrastructure Development	769.7	1,795.9	2,565.6	
Rural Infrastructure Development	243.4	588.0	831.4	
Agricultural Support Service Facilities	261.4	485.5	746.9	
2 Land Acquisition	15.0	0.0	15.0	
3 Engineering and Administration	195.0	439.0	634.0	
4 Purchasing of O & M Machinery	0.0	0.0	0.0	
5 Physical Contingencies	130.0	292.7	422.7	
Grand Total	1,640.0	3,658.5	5,298.5	

Maintenance cost of the project facilities is estimated at Bs 252,850 for short term stage, at Bs 313,670 for middle term stage and at Bs 355,640 for long term stage. Replacement cost of agricultural and rural infrastructure is estimated at US\$ 1,801,000 for short term stage, US\$ 301,000 for middle term stage and US\$ 271,000 for long term stage. Annual expense and income regarding CRC and AC are summarized as shown below.

Expense Item	Short Term	Middle Term	Long Term	Source of fund
(1) Administration:				
- Personnel Expense	146,400	175,200	175,200	Machinery lease service,
- Machine operation	39,600	46,800	46,800	Products sale
(2) Maintenance:				
- CRC, AC building	10,950	15,770	17,240	Machinery lease service
- Canal	23,900	26,900	31,000	Machinery lease service
- Road	32,000	49,000	85,400	Machinery lease service
Sub Total{(1)+(2)}	252,850	313,670	355,640	
(3) Operation:				
- Training	(207,495)	(422,037)	(422,037)	Development support fund
- Demonstration	2,557	2,672	2,756	Products sale
	(462,902)	(738,379)	(780,433)	
Total	255,407	316,342	358,396	

Item	Unit: Bs./year		
	Short Term	Middle Term	Long Term
Machinery lease service			
- Construction machinery	37,440	56,160	74,880
- Farm machinery	191,608	191,608	191,608
- Transport machinery	50,080	83,120	116,160
Products sale	13,447	15,019	15,776
Total	292,575	345,907	398,424

12 Project Evaluation

The project appraisal only deals with the short term development plan of the three term project proposal for the development of the Keka river basin. It deals with financial, economic, and community aspects of the project. Comparison of the "with" situation and "without" situation of the discounted flows of benefit and cost will be made.

The net present value (NPV) of short term projects is estimated at US\$ -0.04 mil. and its economic internal rate of return (IRR) is estimated at 11.9 percent. Sensitivity analysis is carried out on the short term projects by economic prices and results are as follows;

- i) the benefit would be ten percent less than the value estimated in the economic analysis 10.0%
- ii) the cost would be ten per cent more than the value estimated 10.1%
- iii) the case i) and ii) are combined 8.3%

In view of economic aspects, implementation of the proposed development plan (short term stage) can be evaluated at 11.9 % with the index of economic internal rate of return (EIRR). As for the financial point of view, effects to the farmers' economy can be estimated at 45% to 63% of incremental surplus compared with the present situation. By the project implementation, following socio-economical impacts are expected in addition to the benefit estimated by financial and economical evaluation.

- 1) Suitable supply and diversification of agricultural products
- 2) Increase employment opportunity
- 3) Increase of an intention for working
- 4) Activate a socio-economical activity
- 5) Development of regional economy
- 6) Improvement of human resource
- 7) Effect to environment

With these stand points, the implementation of the Project is justified.

13 Conclusion and Recommendation

(1) The project is benefited directly to the inhabitants of the area and will give social and economical impact to the nation and the region by the implementation of development in Altiplano. It is recommended that the government of Bolivia would prepare necessary procedure for early implementation based on the F/S study.

(2) The facility plan and the cost of the project studied in the F/S study should be reviewed at the stage of the detail design for more precise. It is required additional topographic and geological survey for detailed design additionally.

(3) The project implementation body is La Paz department under the supervision of Ministro de Agricultura, Ganadería y Desarrollo Rural. Establishment of Coordination Organ of the project implementation is recommended at the Dirección Desarrollo

Económico, which is one of the departments in governmental organization of Department of La Paz for effective management. Coordination Organ will coordinate the project with the government of Bolivia during the beginning of the project till the end of the construction works and work for supporting the operation of CRC after the construction works.

(4) The activity of the farmers in CRC is an essential in achievement of the project objectives. The recommendation on management and activity regarding CRC is as follow.

- On management of CRC, establishment of a management committee which will be organized by representatives of the member communities. The committee will arrange O & M works of the facilities and plan and conduct supporting programs on agriculture and livelihood of member farmers.
- On operation and activity of CRC, utilization of financial support by the administrative system of the law of "Participacion Popular" is planned. The corporation of the municipalities of Achacachi and Batallas and FDC is essential and it is recommended cooperation Organ establish a close cooperative relation with those organizations.
- On the activity of CRC regarding technical matter, support by research institutes, universities and NGOs are planned. It is recommended to Coordination Organ to establish close cooperative relation with those institutions.

**THE FEASIBILITY STUDY
ON
AGRICULTURAL DEVELOPMENT OF ACHACACHI AREA,
DEPARTMENT OF LA PAZ**

MAIN REPORT

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ABBREVIATIONS

INSTITUTIONS & ORGANIZATION

• BID	BANCO INTERAMERICANO DE DESARROLLO
• BM	BANKO MUNDIAL
• CAF	CORPORACION ANDINA DE FEMENTO
• CNRA	CONSEJO NACIONAL DE REFORMA AGRARIA
• CODENA	CONSEJO DE DESARROLLO MACIONAL
• COMIBOL	CORPORACION MINERA DE BOLIVIA
• CORDEPAZ	REGIONAL DEVELOPMENT CORPORATION OF LA PAZ
• EMV	EMPRESA METALURGICA VINTO
• FAO	FOOD AND AGRICULTURE ORGANIZATION
• FDC	FONDO DE DESARROLLO CAMPESINO
• FFP	FONDO FINANCIERO PRIVADO
• FIDA	FONDO INTERNACIONAL DE DESARROLLO AGRICOLA
• FINEX	FONDO DE INVESTIGACION Y EXTENSION
• FIS	FONDO DE INVERSIÓN SOCIAL
• FNDR	FONDO NACIONAL DE DESARROLLO REGIONAL
• FONAMA	FONDO NACIONAL DEL MEDIO AMBIENTE
• FONPLATA	FONDO FINANCIERO DE LA CUBENCA DEL PLATA
• IBTA	BOLIVIAN INSTITUTE OF AGRICULTURAL TECHNOLOGY
• INC	INSTITUTO NACIONAL DE COLONIZACION
• INE	INSTITUTO NACIONAL DE ESTADISTICA
• INFOCAL	INSTITUTO DE FORMACION Y CAPACITACION LABORAL
• INRA	INSTITUTO NACIONAL DE REFORMA AGRARIA
• IPC	INDICE DE PRECIOS AL CONSUMIDOR
• IPD	INSTITUCIÓN PRIVADA DE DESARROLLO
• MDE	MINISTERIO DE DESARROLLO ECONOMICO
• MDH	MINISTERIO DE DESARROLLO HUMANO
• MDSMA	MINISTERIO DE DESARROLLO SOSTENIBLE Y MEDIO AMBIENTE
• MH	MINISTERIO DE HACIENDA
• MP	MINISTERIO DE LA PRESIDENCIA
• MRE	MINISTERIO DE RELACIONES EXTERIORES
• NBI	NECESIDADES BASICAS INSATISFECHAS
• NGOs	NON GOVERNMENT ORGANIZATION
• PDCR	PROYECTO DE DESARROLLO DE COMUNIDADES RURAL
• PDM	PLAN DE DESARROLLO MUNICIPAL
• PEA	POBLACION ECONOMICAMENTE ACTIVA
• PGDES	PLAN GENERAL DE DESARROLLO ECONOMICO Y SOCIAL
• PIB	PRODUCTO INTERNO BRUTO
• PNAT	PROYECTO NACIONAL DE ADMINISTRACION DE TIERRAS
• PNUD	PROGRAMA DE NAACIONAL UNIDAS PARA EL DESARROLLO
• PRODISE	PROGRAMA DE PRODUCCION Y DIFUSION DE SEMILLAS
• PROMIC	PROGRAMA DE MICROCUENCAS
• PRONAR	PROGRAMA NACIONAL DE RIEGO
• SAFCO	SISTEMA DE ADMINISTRACION FINANCIERA Y CONTROL GUBERNAMENTAL
• SBEF	SUPERINTENDENCIA DE BANCOS Y ENTIDADES FINANCIERAS
• SDR	SUBSECRETARIA DE DESARROLLO RURAL
• SENET	SERVICIO NACIONAL DE EDUCACION TECNICA
• SIPFE	SUBSECRETARIA DE INVERSION PUBLICA Y FINANCIAMIENTO EXTERNO
• SNAG	SECRETARIA NACIONAL DE AGRICULTURA Y GANADERIA
• SNC	SERVICIO NACIONAL DE CAMINOS
• SNEN	SECRETARIA NACIONAL DE ENERGIA
• SNH	SECRETARIA NACIONAL DE HACIENDA
• SNIP	SISTEMA NACIONAL DE INVERSION PUBLICA
• SNP	SECRETARIA NACIONAL DE PLANIFICACION

- SNPP SECRETARIA NACIONAL DE PARTICIPACION POPULAR
- SNRNMA SECRETARIA NACIONAL DE RECURSOS NATURALES Y MEDIO AMBIENTE
- SNT SECRETARIA NACIONAL DE TRANSPORTES
- SIDESA SISTEMA DESCENTRALIZADO DE SANIDAD AGROPECUARIA
- SINSAAT SISTEMA NACIONAL DE SEGUIMIENTO A LA SEGURIDAD ALIMENTARIA Y ALERTA TEMPRANA
- SIRESE SISTEMA DE REGULACION SECTORIAL
- SIVEX SISTEMA DE VENTANILLA UNICA
- TGN TESORO GENERAL DE LA NACIONAL
- UDAPE UNIDAD DE ANALISIS DE POLITICAS ECONOMICAS
- UDAPSO UNIDAD DE ANALISIS DE POLITICAS SOCIALES
- UDAPTI UNIDAD DE ANALISIS DE POLITICAS DE TERRAS
- UPIA UNIDAD DE PROMOCION DE LA INVESTIGACION AGRARIA
- YPFB YACIMIENTO PETROLIFEROS FISCALES BOLIVIANOS

MONETARY UNIT

- Bs. BOLIVIANOS
- US\$ UNITED STATES DOLLAR

SOCIAL & ECONOMY

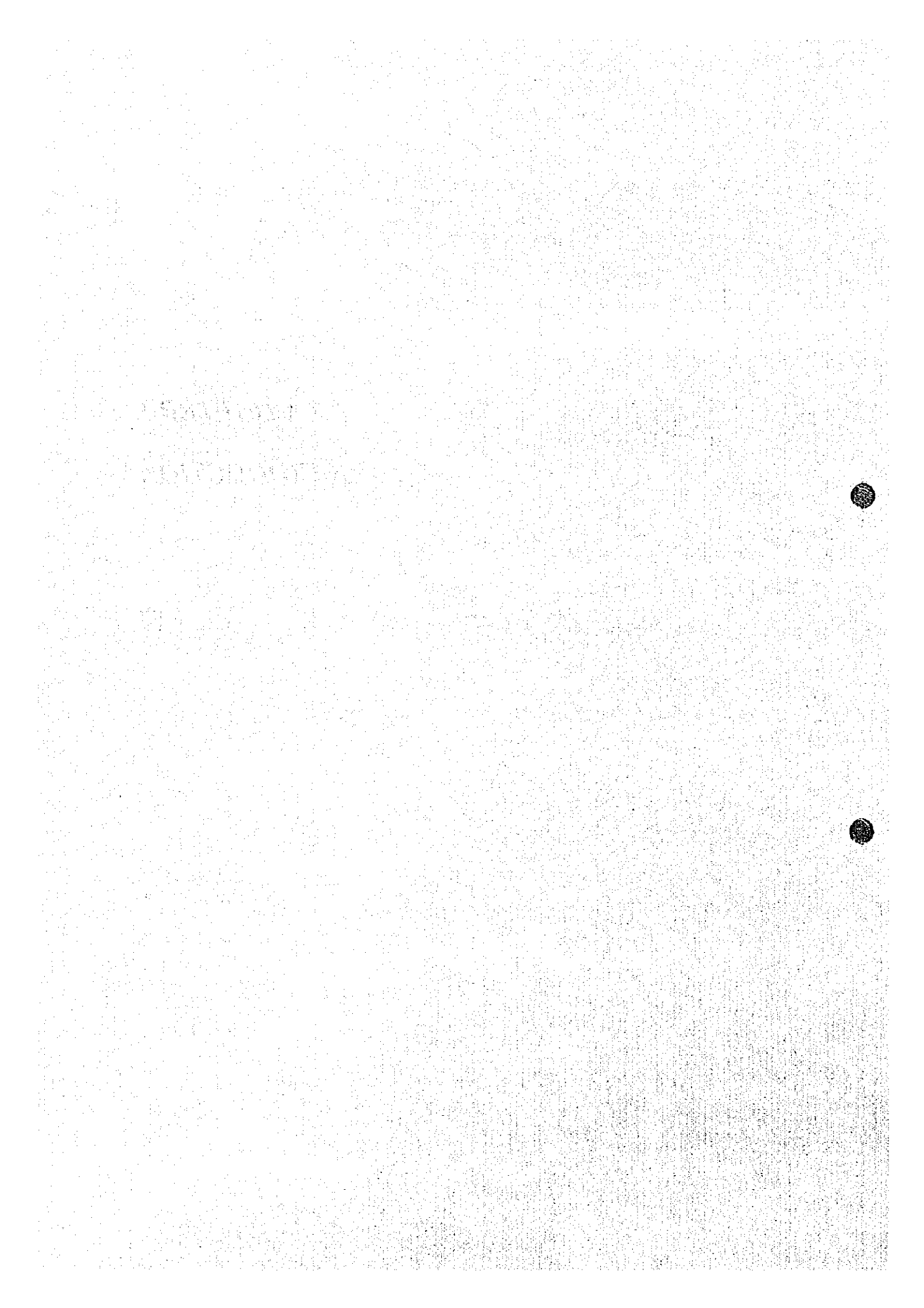
- B/C BENEFIT COST RATIO
- CIF COST, INSURANCE AND FREIGHT
- EIRR ECONOMIC INTERNAL RATE OF RETURN
- FIRR FINANCIAL INTERNAL RATE RETURN
- ENPV ECONOMIC NET PRESENT VALUE
- FOB FREE ON BOARD

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
- mm MILLIMETER
- cm CENTIMETER
- m METER
- m² SQUARE METER
- MCM MILLION CUBIC METER
- m³/s CUBIC METER PER SECOND
- km KILOMETER
- km² SQUARE KILOMETER
- g GRAM
- kg KILOGRAM
- ton METRIC TON
- ha HECTARE
- °C DEGREE CENTIGRADE
- mS/cm MICRO SERGE PER CENTIMETER
- HP HORSE-POWER
- ppm PARTS PER MILLION
- lit. LITTER
- mg/l MILLIGRAM PER LITTER
- md MAN-DAYS
- f.g.p FARM GATE PRICE
- CEC CATION EXCHANGE CAPACITY

CHAPTER 1

INTRODUCTION



CHAPTER 1 INTRODUCTION

1.1 Authority

This Final Report for the Feasibility Study on Agricultural Development in Achacachi Area (hereinafter referred to as "the Study") was prepared in accordance with the Scope of Work for the Study agreed upon between the Secretaria Nacional de Agricultura y Ganaderia (hereinafter referred to as "SNAG") of the Republic of Bolivia and Japan International Cooperation Agency (hereinafter referred to as "JICA") on July 24, 1996.

The Study was conducted in two steps; Phase I and Phase II. During the Phase I Study from middle of November 1996 to end of March 1997, comprehensive basin study was carried out and basic development plans of the Study were subsequently identified. In the Phase II Study from beginning of May 1997 to beginning of September 1997, further study and analysis of the objective areas were carried out and the development plans of the Study were finally formulated.

The Final Report consists of the Main Report and Annexes. The Main Report comprises the results of feasibility study carried out during the field and office works in Phase I and Phase II. The Annexes describe detailed analysis, explanation and results of the study including the present features and conditions of the study areas.

1.2 Background

Agricultural sector including fishery and forestry in Bolivia is attained important role of national economy. Total products of the sector occupy around 16 percent of Gross Domestic Products (GDP) in 1995 basis. According to the ANUARIO ESTADISTICO 1995, a total population in Bolivia was estimated at about 7.41 million. Approximately 42 % of a total population, equivalent to 3.1 million, is engaged in agriculture and dwelled in the rural areas.

The agriculture in Bolivia is divided roughly into two farming systems: traditional farming system (small-scale and self-sustaining) performed mainly in the Altiplano and Valle, and a comparatively new farming system (large-scale and enterprising) developed in the Llanos. The Altiplano and Valle, which hold at about 70 % of a total population in Bolivia, still play important social and economic role of the country, however, over 80 % of a rural population in these areas suffer poverty situation. Migration of these rural habitants to large cities is now causing social problems such as excessive concentration of population in large cities.

Taking these social situations into account, SNAG was established in 1993 an "Regional Agricultural Development Program Joint to Intermediate Cities" in line with the "Basic Plan for Intermediate Sector Development 1994-1997" which is the basic strategy for promoting agriculture of the country. The program intends to alleviate the poverty situation and to control the migration flow into large cities through improvement of infrastructures for the agricultural production and the living environment in leading rural cities and its outskirts.

Under these present situation, the Government of Bolivia requested the Government of Japan in October 1995 to undertake a Feasibility Study on Agricultural Development in the Achacachi area, Department of La Paz, which was designated as a priority development area in the "Regional Agricultural development Program joint to Intermediate Cities". In response to the request, the Government of Japan dispatched the Preparatory Study Team through JICA, and agreed on the Scope of Work for the Study in July 1996, according to which the Study was undertaken.

1.3 Scope of Work

The Scope of Works for the Study is summarized as follows;

(1) Objectives of the Study

The objectives of the Study are:

- i) to conduct the Feasibility Study in order to formulate a rural and agricultural development plan in Achacachi area, and
- ii) to carry out technology transfer to the counterpart personnel of the Bolivian Government during the course of the Study.

(2) Study Area

The Study area covers a area of approximately 8,000ha of Achacachi municipality and its peripheral rural areas (middle and down stream reaches of the Keka river) in Department of La Paz.

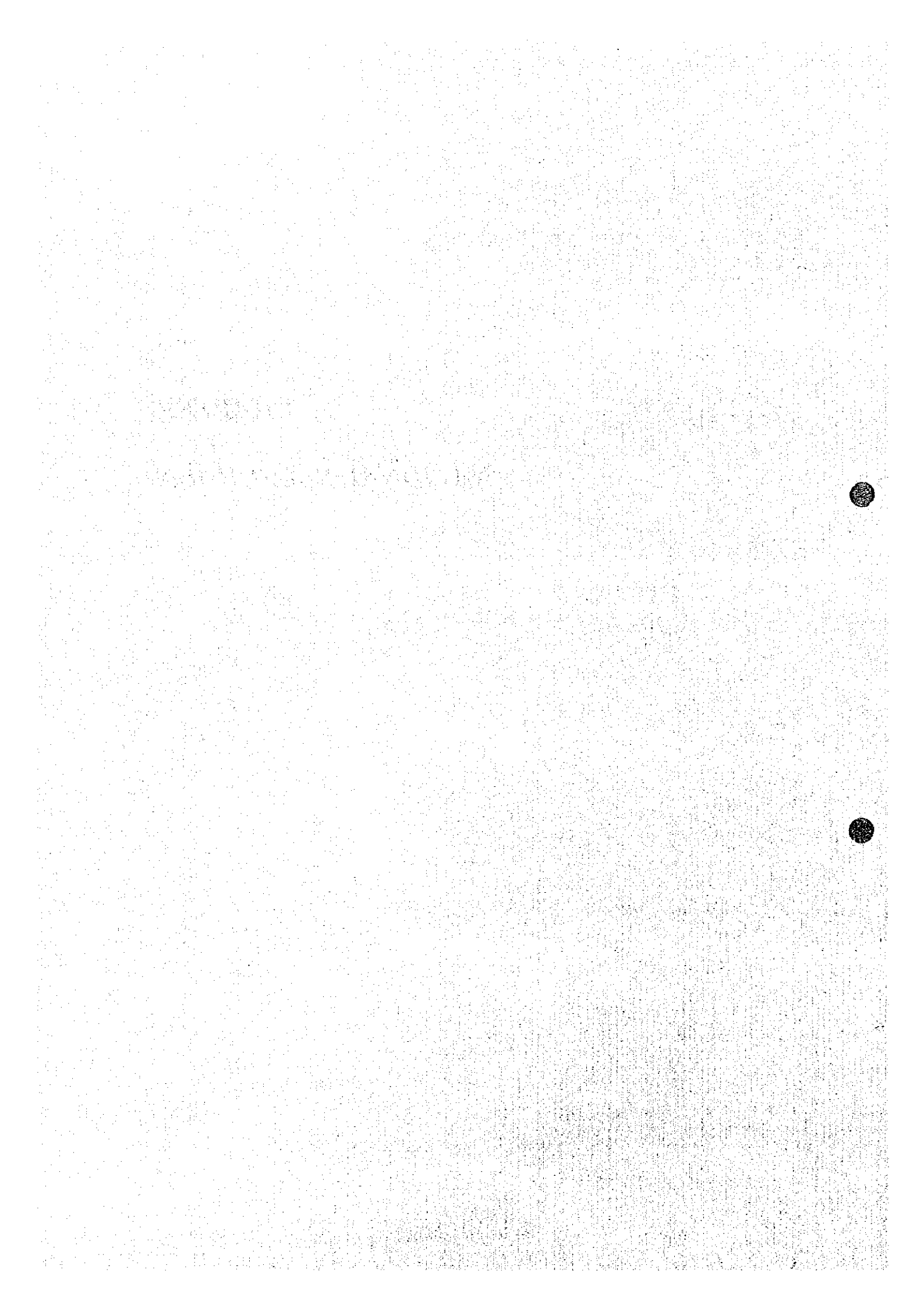
(3) Scope of the Study

The Study is carried out in two phases, Phase I and II. The scope of work on each phase is as follows;

- 1) Phase I Field Study
 - Explanation of the Inception Report
 - Field survey to formulate the basic concept of the development
 - Arrangement and execution of the sub-letting works
 - Soil survey and laboratory test, water quality analysis
 - Inventory survey of existing irrigation and drainage facilities
 - Rural society and farmer's intention survey
 - Aero-photo shooting and control survey for the topographic map
 - Preparation and submission of the Progress Report (I)
- 2) Phase I Home Office Work
 - Preliminary settlement of the rural and agricultural development plan
 - Preparation of the topographical map
 - Preparation of the Interim Report
- 3) Phase II Field Study
 - Explanation of the Interim Report
 - Supplemental investigation for the development plan
 - Arrangement and execution of the sub-letting works
 - Topographical survey for structure sites
 - Soil mechanical survey
 - Formulation of the rural and agricultural development plan (draft)
 - Preparation and submission of the Progress Report (II)
- 4) Phase II Home Office Work
 - Establishment of the rural and agricultural development plan
 - Preparation of the Draft Final Report
- 5) Explanation and Discussion of the Draft Final Report
- 6) Preparation of Final Report

CHAPTER 2

NATIONAL BACKGROUND



CHAPTER 2 NATIONAL BACKGROUND

2.1 Land and Population

2.1.1 Land

Bolivia is broadly divided into three geographical zones on the basis of the topographical features and climate, mountainous and plateau zone called as Altiplano with the altitude of around 4,000 m, valley zone called as Valle ranging from 1,000 to 2,500 m in altitude and the eastern plain named as Llanos with the altitude of 200 to 500m. Total area of the country is 1,098,600 km² and its land use is categorized as follows;

Land Categories	Area (km ²)	Share (%)
Grass and shrub lands	338,307	30.81
Forest	564,684	51.40
Agricultural land	28,794	2.62
Swamp area	24,201	2.20
Water area	14,197	1.29
Barren land	126,101	11.47
Icebound area	2,148	0.20
Urban areas	149	0.10
Total	1,098,581	100.00

Out of the total area of the country, Department of La Paz occupies around 10 %, 130,295 km². Total area of the Omasuyos and Los Andes provinces is 2,065 km² and 1,658 km², respectively.

2.1.2 Population

The population of Bolivia in 1995 is estimated at about 7.41 million and the annual growth rate is 2.41 % during the 1990 to 1995 according to the ANUARIO ESTADISTICO 1995, Instituto Nacional de Estadística (INE). Population in La Paz Department is at about 2.17 million. Economically active population is counted at 2.53 million for whole nation as well as 0.76 million for La Paz Department. The population density is estimated at about 6.8 persons/km² in the entire country, while 14.6 persons/km², 35.7 persons/km² and 37.5 persons/km² are the Department of La Paz, Omasuyos and Los Andes Provinces, respectively.

The population (over 6 years old) who uses Aymara idiom habitually is around 0.17 million of which over 90 % population dwells in the La Paz Department. Also population who uses both Aymara and Spanish idioms is counted at 0.87 million based on the data of 1992 Population Census.

2.2 Present Socio-economic Situation

2.2.1 Politics

(1) Short Political History

The Aymara speaking empire had been dominating the area for nine centuries before she was conquered by the Quechua speaking Inca empire in the 15 century, which succumbed in turn to the Spanish empire in the 16th century.

It attained independence from Spain in 1825. With the decline of production of silver from the rich mountain of Potosí, it had been losing territory by two wars, i.e., giving away the department of the Littoral to Chile in 1874 after the war of the pacific against Chile to become a landlocked country, and lost the department of Chaco in 1935

after the Chaco war against Paraguay; and selling away the department of Acre to Brazil in 1903.

This continuous shrinkage of territory due to mismanagement of the resources by army and established oligarchy ignited revolutionary feeling among the people which crystallized into the forming of "Movimiento Nacionalista Revolucionario (MNR)" in 1942. The party succeeded in forming the government in 1952 getting support from the trade unions of miners, teachers, and peasants. The government introduced land reform and universal adult suffrage that would cause the fundamental change in the social structure of the country. Though military backlash followed some time, the framework of democratic institution has been maintained since 1982.

(2) Recent Political Movement

The general election held 30th June, 1997 made the last MNR- led coalition government change into the new ADN-led government (ADN: Acción Democrática Nacionalista). The president is an ex-president, ex-general, Hugo Bánzar Suárez. The three partners are Movimiento Izquierda Revolucionaria, Unidad Cívica Solidaridad, and Conciencia de Patria.

(3) Structure of Administration

La ley de ministerios del poder ejecutivo (1993) deduced the number of ministries into ten. In September 1997, number of ministries were reorganized into 14 due to a structural reform of the government ; they are:

- i) Ministerio de Relaciones Exteriores y Culto,
- ii) Ministerio de Gobierno,
- iii) Ministerio de Defensa Nacional,
- iv) Ministerio de la Presidencia,
- v) Ministerio de Justicia y Derechos Humanos,
- vi) Ministerio de Hacienda
- vii) Ministerio de Desarrollo Económico,
- viii) Ministerio de Educación, Cultura y Deportes,
- ix) Ministerio de Desarrollo Sostenible y Planificación,
- x) Ministerio de el Trabajo y Microempresa
- xi) Ministerio de Salud y Previsión Social
- xii) Ministerio de Agricultura, Ganadería y Desarrollo Rural,
- xiii) Ministerio de Comercio Exterior e Inversión, and
- xvi) Ministerio de Vivienda y Servicios Básicos.

(4) Administration

Ministerio de Agricultura, Ganadería y Desarrollo Rural (MAGDR) is further divided into four viceministro, i.e., 1. Agricultura y Ganadería, 2. Desarrollo Rural, 3. Explotación Integral de Recursos Naturales Renovables and 4. Desarrollo Alternativo. Dirección Nacional de Riego y Suelos, national counterpart body of the Study, belongs to the viceministro de agricultura y ganadería. After the promulgation of 'Ley de Decentralización Administrativa (1995)' the power of execution of projects has been transferred to the concerned prefecture. Its organization is explained in Chapter 3.

2.2.2 Society

According to Mapa de Pobreza 1995, 37% of the households in the country are considered as extremely poor, 33% are as poor, and 30% are as non-poor. It is indicated that there is a significant gap between the urban and rural areas of the country. In the urban area, 13% of the households are extremely poor, 38% are poor, and 49% are non-poor. On the other hand, in the rural area 68% are extremely poor, 26% are poor,

and only 6% are non-poor.

The data of the Department of La Paz shows the similar characteristics. 39% of the households in La Paz are extremely poor, and 30% are non-poor. In the urban area, 17% are extremely poor, 38% are poor, and 45% are non-poor, while in the rural area, 74% are extremely poor, 22% are poor, and only 4.5 % are non-poor.

2.2.3 Economy

(1) GDP

Gross Domestic Production (GDP) in Bolivia is as follows:

	Unit	1992	1993	1994	1995	1996
GDP*1	bn.Bs.	20.5	23.0	26.0	29.7	33.9
GDP growth*2	%	2.8	4.1	5.0	3.7	3.6
Population	mil.	6.92	7.07	7.24	7.40	7.57

source: INE, *1 at market price; *2 real, agricultural sector-1996: 3.3%.

Trade had been liberalized and state enterprises had been privatized in spite of strong opposition, which was reflected to the result of the general election. Yet, the new government would find no other way but to follow the same direction set by the previous government in the economic restructuring process in spite of its election slogan.

(2) Employment

According to the 1992 census, 44 percent of the labour force were in the agriculture sector, 33 percent in the commercial/ service sector, and less than 10 percent in manufacturing sector; 39 percent of the labour force were employed in the formal economy, and 48 percent were self-employed. The labour force had grown 6.1 percent annually during 1989 and 1991. Unemployment statistics are given below.

	1985	1986	1987	1988	1989	1990
% *	18.0	20.0	20.5	18.0	20.0	12.0

* % of labour force, source: ILO

(3) Consumer Prices

	Unit	1992	1993	1994	1995	1996
Inflation	%	12.1	9.4	7.9	10.2	12.5

Source: IMF

Thanks to the restrictive monetary policy inflation rate has been gone down; year-end inflation rate of 1996 was 7.9% on the previous year-end, the monthly rate since Sep. 1996 to May 1997 had been below 1%.

(4) Finance

Money supply has been controlled to satisfy IMF. The yields of treasury bonds was 7.3% in 1996; the annual interest rate within the banking system has been 18% for two years, which shows that inefficiency in the banking system itself is too high to induce the loan to the productive sectors.

(5) Foreign Exchange

The central bank has been setting the base rate in twice- weekly auctions.

	Unit	1992	1993	1994	1995	1996
average	Bs/\$	3.90	4.27	4.62	4.81	5.09

Bs.5.17/\$ as of Dec.31,1996 and Bs.5.23/\$ as of June 30, 1997.

(6) Government Budget

The government budget on 'Estrategia Transformación Productiva del Agro-Pecuario (ETPA)' for 1997 is as follows:

Item	mil.US\$					
	1996 Executed	%	1997 Budget	%	97/96	
TPA	26.7	4.5%	36.3	5.9%	36.0%	
Human Development	82.2	14.0%	99.2	16.2%	20.7%	
Management of Natural Resources	20.1	3.4%	31.7	5.2%	57.7%	
Road & Irrigation Canal	178.2	30.3%	180.9	29.6%	1.5%	
Complementary Actions	88.0	14.9%	102.3	16.7%	16.3%	
Total Investment of ETPA	395.2	67.1%	450.4	73.7%	14.0%	
Other Investment	193.5	32.9%	161.1	26.3%	-16.7%	
Grand Total	588.7	100%	611.5	100%	3.9%	

Source: Razon Julio I

Government budget for the execution of 'Ley de participación Popular' is 983 mil.Bs. in 1997. 26 percent increase from 1996. Number of municipalities participated is 311.

In 1995, Prefectura de La Paz got a budget allocation of 293 mil.Bs., 90 percent of which had its financial source identified (265 mil.Bs). Achacachi Municipality got 2.7 mil.Bs., and Batallas got 1.2 mil.Bs. A breakdown of budget for Prefectura de La Paz in 1995 is as follows:

1995	Bs.
Aero-Livestock	2,438,468
Communication	132,426
Education & Culture	29,750,078
Energy	11,640,785
Industry & Tourism	320,525
Multisectorial	31,624,864
Water Resources	4,504,698
Health & Social Security	4,598,951
Basic Sanitation	38,454,227
Transportation	8,422,213
Urban Housing	161,544,636
TOTAL	293,431,871

Source: INE Anuario Estadístico 1995

In 1997, Prefectura de La Paz got a budget allocation of 290 mil.Bs. (financial source identified). Achacachi Municipality got 9.2 mil.Bs., and Batallas got 2.6 mil.Bs.

(7) Balance of Payment, Foreign Reserve, and External Debt

	Unit	1992	1993	1994	1995	1996
Export*1	mil.US\$	608	716	985	1,042	1,174
Import*2	mil.US\$	1,041	1,112	1,122	1,385	1,567
Current Account	mil.US\$	- 534	- 506	- 218	- 413	- 431
Reserve*3	mil.US\$	182	223	451	660	955
External Debt	mil.US\$	4,223	4,220	4,749	5,193	5,013*4

*1: FOB, *2: CIF, *3: excluding gold, *4: provisional.

Source: Banco Central.