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REGIONAL DEVELOPMENT OF THE TROPICAL CHAPARE OF BOLIVIA

VOLUME I

WORK ORDER No. 3

November, 1979

Multinational Agribusiness Systems, Inc.
IQC No. AID/SOD/PDC-C-0186

REGIONAL DEVELOPMENT

of the

TROPICAL CHAPARE

of

BOLIVIA

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EXECUTIVE SUMMARY

The Report consists of 7 parts, 3 of which are further divided into 12 major Chapters. Each of these 17 sections are summarized below in the order in which they appear in the Report.

I. Introduction

This section explains why the report was limited to the Chapare and defines its purpose, i.e. to provide the basis for a Project Paper for an Area Development Program for the Chapare. The Introduction then deals with questions of functional and geographical coverage and time span for the proposed program, examining briefly a series of alternatives and concluding that limited social investment should be programmed and that the proposed Area Development Authority (ADA) should have competence to deal with all aspect of social as well as economic development; that the project Universe should be limited to the colonized area, but the ADA's jurisdiction should extend over the entire region; and that the immediate AID input should be conceived as a five year injection of capital, but that a series of development mechanisms should be created which have a continuing and indefinite life.

The Introduction also describes the methodology used and the approach to determining financial levels.

II. Development Objectives and Strategy to be Followed

This section defines the objectives of the proposed program as increasing the incomes of the approximately 10,500 small farm families located in the Chapare by stimulating crops other than coca to a point where reasonable family income levels would obtain without income from coca; creating institutional mechanisms which can provide continuity to the development effort over time; and providing the basic economic infrastructure needed to support the development effort.

A nine point strategy for accomplishing these objectives is then described: (1) to change cropping systems from slash and burn to a permanent use, legume ground cover system; (2) to develop interventions on a micro-zone basis; (3) to use a two track intervention system in each zone, i. e. assist farmers with current production and introduce one or more new production lines into each micro-zone; (4) to emphasize private local capital and entreprenourship for agro-industry and, when feasible, to consider vertically integrated corporations as a vehicle; (5) to assure that markets exist before recommending the promotion of any product; (6) to examine places in the food system where losses occur and where remedial action could result in increased income to the producer; (7) to entrust the administration of the AID supported program and the development of the region to an autonomous or semi-autonomous Area Development Authority located in Villa Tunari and which can deal with implementing agencies and/or contractors directly at the local level; (8) to work with and through the farmers' organizations presently existing in the Chapare; and (9) to promote a nucleation of the population, to the extent feasible, into growth poles.

III A. Description of the Region

The region is examined in terms of its physical and ecological characteristics, its actual and potential land use, the colonization process, the situation with regard to concessions and cooperatives, the sociological characteristics of the population, and the criteria and application of same in defining micro-regions.

The principal points which emerge from this examination are as follows:

(1) Although not usually considered part of the tropical Chapare, which totals approximately 147,000 hectares, and contains about 10,500 families located on 11,446 farm units, the colonized area of Espíritu Santo/Locotal/Tablas Monte should be included in the project area.

(2) Of the total land area of the region (approx. 2,690,000 has.), in addition to the colonized area there are 200,000 hectares in public and private concessions; 900,000 hectares is a national park; and 1,243,000 hectares in the public domain.

(3) Although there is considerable agricultural land in the public domain which is suitable for colonization, pressure is already being exerted on both the national park and the concession areas

(4) Two procedures were followed in developing the region: directed colonization, where 20 hectare units were provided and settlers were organized into cooperatives; and spontaneous colonization, where 10 hectare units were settled under a sindicato arrangement. Today, there is no significant difference in the organizational structure of the 2 groups --the former having converted to the sindicato structure. In general, the

spontaneous settlers appear to have made more progress.

(5) By and large, the area in concessions is not being developed at present.

(6) Cooperatives of various types have been organized in the Chapare. In general, they have not been succesful, but there is a willingness to continue using them when assisted by the right mix of capital and technical assistance.

(7) The Chapare colonists are not typical peasant farmers, but form a special group, with high literacy and educational levels, which has a sense of control over personal destiny and is receptive to change. High priority is placed on the community.

(8) Using a combination of social, ecological, economic and administrative considerations, the colonized area is divided into 9 micro-regions, each of which is described and potential new production indicated. (See also map N° 3).

III B. Current Production: Problems and Oportunities

The current farm production system (land clearing, crop production) and their consequences -a lowering of the productive potential of the area- are described in some detail. A new 5 year rotation system designed to permit permanent cropping with hand labor and traditional tools and to simultaneously reduce weed intrusion and regrowth of brush is described. The new system involves use of intercropping and multiple cropping; rotation of crops with leguminous forage/ ground cover plants; increasing plant densities; continuous use of minimum or no tillage techniques; and ridging of poorly drained soils.

Next, the crops currently grown are examined, one by one, and possibilities for improvement are noted, as follows:

(1) Rice

Use of low yielding varities, low seeding rates and inadequate weed control are prevalent. Possible improvements include introduction of better seed (e.g. CICA-6 and Bluebell), harvesting in shocks, improved thrashing methods, and the construction of drying patios and storage bins.

(2) Corn

Situation similar to rice, with similar possibilities for improvement.

(3) Peanuts

Good varieties are used, but yields are only fair due to cultural practices, which are susceptible of improvement, e.g. putting soil to plants immediately before they put out spikes.

(4) Papaya

Yields are good and quality of fruit is excellent. Problems are associated with transport and marketing.

(5) Citrus

Criolla varieties are planted from seed and quality is poor and uneven. Also, unsuitable sites are used, agravating disease problems. Production can be greatly improved by zoning, importing phitophtora resistant root stock and grafting this with good quality fruit and wood. Efforts in this direction are

underway, but need to be expanded.

(6) Bananas/Platanos

Yields are average, but could be increased with improved cultural practices. Quality is satisfactory for local demand. Varities suitable for export have been successfully tested. A feasibility study on marketing chilled bananas in Argentine population centers is recommended.

(7) Pineapple

Small farmer production is of criolla varieties, which do poorly from all standpoints. An imported variety, Cayenne Lisa, is being successfully grown on a large farm on a commercial scale. The new variety and accompanying technical assistance should be provided to small farmers. Market potential is good.

(8) Yuca

It is grown in all areas of the Chapare with excellent yields. However, there is no market for commercial level production. Possibilities of dehydrating and marketing yuca as animal feed will be explored.

(9) Avocado

Only suitable for higher altitude areas of the Chapare and yields there are variable. Some adapatation trial with improved varieties are indicated.

(10) Forage

Kudzu, stylosanthes, and centrocema all do well in the Chapare. However, only kudzu is now grown commercially and only on a limited scale.

In addition to crops, the situation with regard to livestock and poultry is examined. With the exception of fish, there is presently no significant commercialization of any type of animal or poultry production by colonists. Successful implementation of the new cropping system discussed above will bring about large scale plantings of legumes that are excellent forage for cattle, buffalo, and swine. Several methods of introducing these production lines to the small farms are discussed.

The next topic examined is the use of the land where it is found that at present 4.56 hectares and 3.77 hectares are cultivated, respectively, on the 10 and 20 hectare farm units. The effect on land use of introducing the new cropping rotation system plus commercial level production of a series of new crops (rubber, tea, cacao, pineapple, and pejivalle) in selected micro-zones is then analyzed under different assumptions. There appears to be a good "fit" for all proposed crops.

With land use patterns, actual and potential, established the report moves to an examination of labor requirements. It finds that there is presently a surplus of family labor. When new product line considerations are introduced some potential problems emerge, but only under "worst case" assumptions. In general, the finding is that labor will probably not be a major constraint to carrying out the proposed program.

We next examine crop production and farmer income. The data is generally bad and the conclusions suspect. However, it shows that average net farmer income is US $ 2,500 with 59% attributable to coca. One does not see physical evidence of this level of income. Informal spot checks indicate that the reason may be significant distortions in income distribution.

The report then analyzes the marketing situation, including a discussion of the intermediaries, the transport system, and the margins corresponding to each. As regards margins, it concludes that returns to the farmer are reasonable from a percentage standpoint; that while the cost of transport is high it is probably not excessive; neither are wholesale margins. Retail margins are inflated due to small volume operations.

Still under marketing, the report goes on to examine some of the more technical problems such as packing of fruit and grading. Demand at the national level and abroad for some of the current production lines is examined, with very inconclusive results, but with the general conclusion that, under present production, processing and national policy conditions, short run prospects for rice, corn, citrus, bananas, yuca, papaya and pineapple are not very promising This conclusion leads, in turn, to some suggestions for an action program. These are: market education; reduction of losses by improvements in internal storage, handling and transport mechanisms; increase of value added at the rural level through processing of certain products; and provision of current price information to farmers.

Following on the above suggestion about processing, the Report examines the agribusiness situation in the Chapare, including proposals for new agro-industry which have been recommended in other studies.

It concludes that processing facilities for tea, rubber, cacao, and dehydration of yuca and bananas can be recommended. Also, a box factory and an in-put supply facility are considered desirable and viable enterprises to promote.

Finally, Part IIIB of the Raport summarizes what has been touched on earlier regarding system losses on the farm, during transport and in marketing. It then attempts to quantify the value of such losses by crop and by hectare. The results are shown in Table III B-11 and are significant.

III C. Potential New Crops and/or Livestock Production

This chapter examines 13 potential new product lines (in addition to swine and pineapple mentioned earlier), in terms of compatibility with new farm production systems, appropriatness for agronomic conditions in the Chapare, suitability for small farmer production, marketing factors, returns to the farmer, and availability of support elements. It finds that 4 crops (tea, cacao, rubber and pejivalle) meet the test and are suitable for promotion on a commercial scale. Three product lines are identified as having potential but where further investigation is needed (coconut palm, coffee and spices). Finally six product lines were not considered suitable for small farmer production in the Chapare, (mangos, macodamia nuts, african oil palm, ornamentals, sunflower/safflower, and poultry and other fowl).

IV. The Area Development Authority

This Chapter discuses a series of issues and alternative approaches to the special problems of administering an integrated development program in the Chapare. The criteria on which the recommended structure was based include: having the planning, coordinating and implementing authority as close as possible to the scene of the action; upsetting as little as possible the jurisdiction of existing agencies; maintaining the momentum which has already been developed in the Chapare; capitalizing on the fact that the economic benefits from development of the Chapare will accrue primarily to the Department of Cochabamba; capitalizing on the expertise on the Chapare which already exists in many government agencies; and finally, locating authority for the program as close as possible to those who will be held accountable for results.

Applying these criteria to the complex of agencies with interests in the Chapare and taking into account the nature of the proposed program plus other development factors, the Report recommends the creation of a new organizational entity called the Chapare Economic Development Authority (CEDA), to be attached for administrative purposes to the Ministry of Agriculture (MACA), and with its head appointed by the Minister and "refrendado" by the President. The principal points defining the location, functioning and setting in motion of the new entity are as follows:

1. The headquarters of CEDA would be Villa Tunari with liason offices in Cochabamba and La Paz.

2. CEDA would be semi-autonomous. Its budget, insofar as national funds were involved, would be a consolidated line item in MACA's budget* and would be supported by a detailed,multi-sectorial CEDA budget document approved by the Control Council (see below).

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* Essentially, the relantionship between the CEDA and MACA budgets should be the same as now obtains between the budgets of the autonomous agencies and MACA.

3. The Director of CEDA would be delegated authority to approve expenditures in accordance with the approved budget. He would also be authorized to select his own permanent staff.

4. All funds, personnel and property of PRODES would be transferred to CEDA except those located in or committed to the Yungas.

5. CEDA would be a planning, financing, servicing and monitoring agency. All project implementation/would be carried out by existing line agencies on the basis of specific project agreements signed with and monitored by CEDA.

6. CEDA would be responsible for both macro and micro level planning in the Chapare. This would include a comprehensive, multi-sectorial five year plan, specific time phased projects designed to achieve the goals of the plan, and annual budgets with detailed expenditure figures by project.

7. CEDA's staff would consist of a nucleus of generalist planners, economic researchers and administrative personnel, augmented by technical specialists paid for by CEDA, but seconded by the line agencies.

8. The 5 year plan, all project plans, and the annual budget would be subject to review and approval by a Control Council established simultaneously with the creation of CEDA. Its Chairman would be the Director of CORDECO. Ex-officio members would include the Departmental representatives of the Ministeries of Agriculture, Health and Education and the Servicio Nacional de Caminos. The head of the Federación of Sindicatos would also be a member.

9. All development funds scheduled for expenditure in the Chapare, in any sector and from whatever source, would be controlled by CEDA.

The report goes on to describe in some detail the functions of all potentially involved agencies, the staffing and administrative organization of CEDA (33 technical and professional personnel), and foreign advisor requirements (a 2 year advisor in Agri-business development, a 2 year regional development specialist, a supervisory highway construction engineer for the life of the project, and one man year of short term advisors per year). Finally, steps required to establish the entity and rules of operation for CEDA are described. The total cost of establishing and operating CEDA over a 5 year period is estimated at US $ 5.3 million.

V A. Program Activities (Introduction)

This section deals with the handling of program funds and recommends that AID and GOB funds be allocated to CEDA by the functional categories outlined in Part V of the Report. It further recommends that, subject to approval of its annual budgets, CEDA have considerable flexibility in the allocation of funds within the region via specific project agreements.

V B. Vertically Integrated Corporations

For three of the recommended new product lines (tea, rubber and cacao) it is believed that the most appropiate development mechanism is a mixed public/private corporation, the fixed assets of which are limited to the plant and equipment necessary for processing, but which provides to the individual producer under contract the entire range of inputs, including credit and technical assistance, necessary to obtain the desired and contracted for product. The financing of these corporations is conceived as being composed of:

a) equity investment (60% by private investors and 40% by CEDA);

b) a 1:1 debt/equity ratio, with the loan coming from CEDA on semi-concessional terms; and

c) a grant from CEDA covering those farmer assistance services normally provided by government agencies.

It is contemplated that 5% of the value of the farmers' sales of raw material to the corporations would be paid to him in stock in the company, sold to him from the shares held by CEDA. Thus, over a period of time the farmers, collectively, become a major shareholder in the corporation. The proposed mechanism of vertically integrated corporations is believed to provide most of the benefits of a cooperative and of private sector entrepreneurship and management.

For each product line, a pre-feasibility study is provided showing marketing, production, credit, processing, farmer return and other pertinent data. Farmer production targets are as follows:

	N° Acceptors	N° Has.
Tea	600	300
Rubber	1,000	2,000
Cacao	2,000	5,000

Illustrative cash flow and profit and loss statements have been prepared. All three corporations appear to be economically viable and, under the proposed financial arrangements, should be attractive to Bolivian entrepreneurs, some of whom, i.e. the end users of the products, have been identified. In our judgement, for the type and size of enterprise contemplated, only local capital should be envisioned.

The total estimated funding from the resources of CEDA (i.e.the project costs) for this component of the proposed program is approximately US $ 6.2 million, of which US $ 1.3 million is in grant funding; US $ 3.5 million is in loans; and US $ 1.4 million is in equity participation.

V C. Other Product Lines

This Chapter describes the program content of specific project elements identified earlier, other than tea, cacao and rubber, and which are proposed for implementation under the research and extension, communications and credit components of the proposed program where the detailed cost estimates are provided. The reason for presenting the material in this fashion is that personnel and other cost elements overlap amongst the various activities.

The project activities dealt with here are: (1) the rotation system package, (2) swine production, (3) citrus improvement, (4) pineapple, (5) pejivalle, (6) an animal production center, and (7) minor emphasis crops, i.e. spices, coffee and coconuts. For each activity, the content and scope is discussed as are management arrangements, what the farmer should do, how the activity is designed to help him, and the returns to the farmer.

The targets set for each activity are as follows:

	N° Acceptors	N° Units
1. Rotation System Package		
a) Legume cover crop/forage	5,000	8,200 has.
b) Fencing	5,000	8,200 has.
c) Grain storage sheds	5,000	5,000
d) Use of improved rice, bean, root crop, and vegetables seed and practices	not quantified	
2. Swine Production	570	10,000 p.year
3. Citrus Improvement	not quantified	750,000 budded trees
4. Pineapple	400	200 has.
5. Pejivalle	1,000	1,000 has.
6. Animal Production Center	not applicable	
7. Minor Emphasis Crops	not applicable	

It is recognized that while, individually, these targets may be achievable, when looked at in the aggregate -especially when the vertical conporation innovations are taken into account- they are somewhat ambitious. It is hoped that, at least to some degree, the problem can be alleviated by programming only certain mixes of new activities for individual micro-zones during the operational planning phase.

V D. Research and Extension

The present situation in the Chapare is described. There is a basis on which to build and it is consequently proposed that the research and extension work be executed by INIA under a series of "convenios" with CBNA, in principle 1 each year for each of the 7 activities described in the preceding Chapter.

The methodology proposed is: (1) to use a technique of production activity managers and teams with proper back up support; (2) to work though the sindicatos; and (3) to use mass media communications.

The proposed program calls for 31 professional and technical personnel organized into 4 Sections (Production, Service, Support and Zonal Agent). The Report also recommends an institutional technical assistance contract under which a six man advisory team and 6 man months per year of short term consultants will be provided. Training, both in and out of country is contemplated and costed. Installation of a radio communications network, vehicle and other equipment adquisition, construction of extension agents' office-homes and other buildings, purchase of office furniture and equipment, and revolving funds for purchase of genetic material and livestock are individually discussed and costed.

The total five year cost of the Activity is estimated at US $ 7.4 million.

V E. Communication Program

It is proposed to establish a Communications Unit for multisectorial use and have it administered directly by the Area Development Authority. It would be staffed by 2 professionals, 2 equipment operators and 1 secretary and be concerned with radio broadcasting (a link up with radio San Rafael and facilities for direct broadcast from Villa Tunari are proposed); production of bulletins, leaflets and other visual aids; and operation of a check out system of audio-visual equipment. Total equipment costs are estimated at US $ 107,470. Total program costs for a five year period come to approximately US $ 403,170.

V F. Credit Program

This Chapter deals with both the amount of credit needed to implement the 7 activities described under Research and Extension and the methods and institutions for delivering the credit. The net requirement for lending, after taking into account farmer self-financing and reflows, is US $ 3.9 million.

The Report analyzes the potential of the Agricultural Bank (BAB) and the National Federation of Credit Unions (FENACRE) for acting as credit delivery agents. Both institutions claim that with help they could each assume the entire responsibility. Our recommendation is: assist both to assume a portion of the responsibility, roughly 50% each. This approach would entail assisting BAB to open 3 new branch offices in the Chapare and to strengthen its Villa Tunari branch, paying only first year costs for each office. The amount of the subsidy would be US $ 149,000. As regards lending funds, an analysis of small farmer lines of credit actually or potentially available to BAB indicates that it should be possible for the bank to reserve US $ 2 million for use in the Chapare. Thus this program would not have to provide BAB with lending capital.

As concerns FENACRE, it would be given a grant by CEDA enabling it to develop a central regional office and 5 credit unions with a membership of approximately 2,000 farmers. The cost of the grant (using FENACRE figures which may be high) is US $ 303,500. In addition, FENACRE would have to be provided with a US $ 1 million loan on concessional terms for relending. Thus the total cost of the credit component of the proposed project is approximately US $ 1.5 million.

V G. Agribusiness Program

This Chapter spells out the program implications of the 3 enterprises identified earlier, additional to the vertically integrated corporations. These are a dehydration plant for Yuca and Bananas, farm supply arrangements, and a box and wood products factory.

1. Dehydration Plant

There is lack of market demand for bananas and platanos; for yuca it is insignificant. The proposed dehydration plant would provide a new market for 11,200 MT per year of farm production and, in turn, would sell 4,500 MT per year of the dehydrated product to Cochabamba Valley manufacturers of formula feed for the poultry and dairy industries. The financial requirements of such an operation are estimated at US $ 700,000. In order to attract private investors, it is proposed that CEDA make a somewhat concessional loan to the company for 50% of this amount, i.e. US $ 350,000.

2. Farm Supply Arrangements

The proposed program will generate a new Chapare demand for approximately US $ 4.4 million of farm inputs, a considerable part of which will be financed with credit provided under the program. An adequate delivery system -public, private or cooperative- does not exist in the Chapare. Various alternatives for installing a satisfactory system are explored. The preferred arrangement is

for CEDA to promote a wholly private owned network. As a fall back, a mixed public/private corporation, with CEDA taking a 40% equity position, calculated at US $ 100,000, is envisioned and included in the project budget.

3. Box and Wood Products Factory

The principal objective is to produce adequate containers for use at all stages of the food system. Other products needed by the program can be fabricated, e.g. fermentation trays for tea and cacao. Markets seem assured. Promotion by CEDA of a private enterprise is recommended. Financial support, preferably via a loan, will probably be required in the amount of approximately US $ 50,000.

V H. Marketing Program

The elementsof a modest start on improving the existing marketing system have been incorporated in various sections of this report and have been costed where they occur; consequently no separate marketing budget is provided for. The Chapter simply brings these diverse elements together as follows:

1. Information Flow

Information on the supply and demand situation and on prices will be gathered by the CEDA Cochabamba office, relayed by existing SSB equipment to Villa Tunari for broadcast there on a regular basis.

2. Reduction of Losses

The establishment of a box factory should help with transport losses. Also, the Truckers Federation may be asked to open an office in Villa Tunari to improve scheduling of loads.

Best Available Document

Financial support for the latter action, if needed, could come from the CEDA impact project fund.

3. Vertically Integrated Corporations

For tea, rubber and cacao marketing will be handled as part of a business enterprise.

4. Feasibility Studies

Several have been suggested, e.g. marketing of bananas in Argentina. CEDA has a substantial budget for this type of study.

5. Technical Personnel

CEDA's budget provides for suitable personnel.

V I. Area Transport System

A program is proposal under which 178 kilometers of existing roads would be upgraded, 50 kilometers of new road constructed, and necessary ferries, fords, bridges and culverts installed. Maintenance of a 260 kilometer road network is also envisaged. Design specifications and method of work are described for all components.

It is proposed to have the work performed under "convenios" between CEDA and the Servicio Nacional de Caminos (SNC). These would provide for a grant of equipment sufficient to take care of road reconstruction. They should also commit SNC to use its recently acquired, AID financed equipment to meet the new road construction needs and to allocate specified amounts of IDB financial equipment to the Chapare for maintenance work. The total cost of the program is estimated at US $ 12.8 million.

V 5. Electricity and Potable Water Program

This Chapter is built on the assumption that hydro-electric powered distribution systems will be installed in the Chapare starting in early 1982; that this work will be financed by IDB; and that, consequently, no electrification costs need to be budgeted in this program.

Plans for installation of water supply systems already financed by AID were examined against regional development needs. A requirement under this program for 6 additional systems at a cost of between US $ 275,000 and $ 314,000 emerged.

It is proposed that the activity be administered by the Department of Environmental Sanitation under a "convenio" with CEDA, which would provide for using the same design standards, administrative arrangements, etc. as pertain to the AID financed Rural Sanitation Project.

VI Financial Implications of the Program

This section of the report indicates that the total cost of the proposed program comes to US $ 34.5 million.* It finds that there is no component, with the possible exception of the small potable water activity, which could be deleted in its entirety without seriously affecting the viability of all other components. It is, however, possible to reduce program costs by up to US $ 8.6 million by changing certain financial mechanisms and deferring certain activities to a later phase of development of the region. These are described in detail. The activities represented by this US $ 8.6 million are not excess trimmings but rather represent significant, but perhaps not irreparable, reductions in program content.

* Includes $28.8 million in local currency costs when these are calculated at an exchange rate of 20 pesos per dollar, which was the rate in force when this report was prepared. Since then the peso was devaluated to 25 to the dollar. At this exchange rate the local currency costs of the program expressed in dollars would be $23 million, and the total program costs would be reduced to $28.7 million.

Before reducing the program it is suggested that some alternatives, such as a consorcium arrangement with the IDB be explored.

VII Feasibility Considerations

In this Chapter the report compares project costs to expected net benefits and then subjects the results to various sensibility tests. An extremely narrow definition of benefits is used. The basic benefit/cost ratio obtained was 1.69. Applying a series of unfavorable assumptions, the B/C ratio was found to continue favorable in most instances.

I. INTRODUCTION

A. RELATIONS TO TASK ORDER OBJECTIVES

This report was commissioned under Order AID/SOD/PDC-C 0186, Work Order No. 3. The objective stated in the Work Order was:

"(a) To identify essential project components needed to further the development of the Yungas and the Chapare and assist these areas to overcome the economic loss from termination of illegal coca production:

"(b) To elaborate plans for implementation of this development project; and

"(c) To prepare basic documents and feasibility analyses needed for project development and implementation".

It became obvious early in the work that time would not permit dealing in depth with both the Chapare and the Yungas de La Paz regions. It was therefore agreed with USAID/Bolivia that the report would be limited to the Chapare region. It was also agreed with USAID/Bolivia to redefine (or perhaps "sharpen" would be a better term) the purpose or objective of the report. The current intention is to provide the basis for a Project Paper for an Area Development Program for the Chapare. The distinction between the Task Order Statement of objectives for this report and the above restatement, at first glance, appears to be semantics. The reformulation, however, is designed to: (a) emphasize the concept of Area Development with all that implies in terms of an integrated approach versus a collection of projects, and consideration of activities which go beyond the bounds of what AID can properly consider for financing; and (b) to stress the end use of the Report, and consequently its treatment of the data, i. e. a Project Paper. In this regard we have attempted to keep in mind such factors as Section 611 requirements.

B. FUNCTIONAL COVERAGE

Ideally, an Area Development Program should deal with all aspects of development, social as well as economic. In this report the emphasis is on economic activity and related infrastructure, with only one component dealing with social infrastructure, i.e. installation of potable water systems and latrines in certain population concentrations. The reason for this state of affairs derives from the composition of the team which was predetermined by AID, rather than from any concept as to the relative importance of economic as opposed to social development activities in the Chapare.

Initially, we had intended to cover only economic activity and related infrastructure. The fortunate coincidence of finding available a recently completed project design for potable water and latrines proposed by the MACA - INC - CORDECO/OAS team 1/ and the assistance of the USAID Public Health Division permitted us to include this program component, which ranks high on the list of the felt needs compiled by PRODES.

It will also be noted that while the project components recommended in this report for AID financing are limited to this one area of social infrastructure, we are recommending that the proposed Area Development Authority to be supported by AID (See Chapter IV) include in its functions and have the necessary staff capacity to promote and finance the execution of other social development activities, with financing from other sources.

1/ Ricaldes J. Carlos; Guzmán, Hugo y Baciqalupo, Javier "Sub-Programa de Saneamiento." Proyecto Chapare, MACA-INC-CORDECO/OEA. 1979.

C. GEOGRAPHICAL COVERAGE

Map No. 1 indicates the portions of the various provinces which make up the tropical Chapare. In land tenancy terms, the Chapare may be divided into four components: the area dedicated to a national park, the area granted to public and private entities in the form of medium and large concessions, the area in unassigned public lands, and the area granted to small holders under spontaneous and directed colonization schemes (See Map No. 2 and Chapter III. A. 2 for more detail).

From the standpoint of the proposed AID financed program, the universe is limited to the latter category. However, as in the case of functional coverage, we believe that the recommended Area Development Authority should have jurisdiction over the entire ecological land area of the Chapare and that its functions and staffing should *inter alia*, include the promotion of estate type development on the larger concessions. While not suitable for AID financial support, the initiation of large plantations can be very beneficial to development of the region and also to the AID target group (the small farmer) in terms of spill-over technology, marketing outlets, etc. Furthermore, there is a constant interaction between the colonists and both the concessions and the national park area in terms of the farmer moving into the latter two land areas, revocations and readjustments in the large concessions, etc.

D. TIME SPAN

The terms of reference of the Work Order do not provide any guidance as to whether the project is to be conceived as a one-shot, medium term effort or as a long term commitment. Definition of this parameter is crucial to how the proposed program is structured. Our solution, which is reflected in the program design, is to provide for a series of development mechanisms which

have a continuing and indefinite life, while limiting initial AID input to a five year injection of capital.

E. METHODOLOGY

The recommendations embodied in this report flow from an examination and evaluation of studies previously executed.[2/] No original research was planned or executed. Of special utility were the many documents prepared by the University of Florida technicians, the MACA-INC-CORDECO/OAS Integrated Development team, and by PRODES. However, several studies which were to have been finished prior to the initiation of this report had either not yet been started or were in process simultaneously with the work of our team. This, of course, has been a constraint. To some extent this constraint was overcome by the PASA team dealing with cacao, spices and dehydrated vegetables, making their notes and drafts available to us and by interfacing with our technicians. The same is true of the team dealing with fruits.

In terms of project design we also wish to acknowledge the extremely close and valuable collaboration of the MACA-INC-CORDECO/OAS group who shared with us the findings of their technicians and collaborated with us on the development of our chapters on the transport/road system, credit and agro-industry. We also had access to the project design for consolidation of the directed colonization area (Chimoré) prepared by IICA for the IDB. We found this of little or no utility, inappropriate for a program proposing to assist the small farmer, and proposing massive investment in livestock production with no attention to processing or marketing considerations.

We have attempted to discuss our findings and recommendations with the Chapare farmers's association (Federación Especial Agraria del Chapare

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2/ Much of the data, which is voluminous, is contradictory and of questionable use as a basis for an action program.

Tropical) and with concerned GOB officials to ensure that what we are proposing has a reasonable chance of being implementable in terms of acceptability to those affected.

F. FINANCIAL LEVELS

We were initially instructed by the Mission to design a program for the Chapare whose total costs, including counterpart contributions, would be in the neighborhood of US$ 20 million. On further discussions, it was agreed that a more suitable procedure would be to determine what needed to be done over the 1981-85 period for each component of the proposed program and to cost out these requirements, component by component. This is the procedure followed to arrive at the cost data given under each of the Program Activities described in Chapter V of the report. The implications of this approach in terms of overall funding are dealt with in Chapter VI of the report.

II. DEVELOPMENT OBJECTIVES AND STRATEGY TO BE FOLLOWED

The overall objective of the proposed AID supported program is relatively simple, i.e. to increase the incomes of the approximately 10,500 small farm families located in the Chapare region. More specifically, the program is designed to:

a) Stimulate the increased income from crops other than coca to a point where reasonable family income levels would obtain without income from coca production.

b) Create institutional mechanisms (public and private) which can provide continuity to the development effort over time and can deal with all aspects of development of the region.[1/]

c) Provide the basic economic infrastructure needed to support the development effort.

In order to achieve these objectives a strategy, relating to the specific conditions found in the Chapare, was developed to provide the underpinings for the various elements of the program design. The main elements of this strategy are as follows:

The first and crucial element of a small farmer strategy -- which applies to all settlers in the region -- is to change the

1/ It should be pointed out that the small farmers occupy only a very small portion of land area of the region; and that there are approximately 37 medium to large land concessions in the region, totalling 200,000 hectares. Even though the objectives and strategy for the AID supported program are limited to the small farmer, the strategy (and institutional mechanism) for development of the region should take into account both types of enterprise. Equally, the institutional mechanism should be capacitated to deal with social as well as economic investment.

current land use pattern of depletion of soils followed by abandonment and/or migration to virgin areas to a cropping, ground cover system which will enable the farmer to use more of his acreage on a continuous basis. The manner in which it is proposed to accomplish this change is described in Chapter III, Section B.

The second element of the strategy derives from the fact that the Chapare is not a homogeneous area, but rather is comprised of a series of microregions in terms of soils and precipitation and, consequently, of agricultural potential. Thus, while the institutional structure of the program should provide for "central" planning for the region as a whole, it should also be designed to give special emphasis to the needs and differences amongst the micro-regions, not only in regard to agricultural production, processing, marketing and related infrastructure matters, but also social development requirements, whether or not financed by AID.

The third component of the strategy relates to the agricultural program. Within each micro-region, the extension - research-nurseries-credit (and in some instances processing and marketing) functions should be conceived on a two track basis. By this we mean that equal attention should be given to: (a) Assisting farmers to overcome problems they are now experiencing with products they are now producing; and (b) The introduction of one or more new lines of production into each micro-zone. The criteria for selection of new product lines are indicated in the introduction to Section C of Chapter III.

The fourth strategy element relates to the agro-industrial aspect of the program. The recommended strategy is to seek arrangements

which, to the extent possible: (a) permit the enterprises to be privately managed, (b) involve local entreprenuers and local capital; and (c) provide protection for the interests of the raw material producer. Consideration should also be given to the possibility of vertically integrated operations centering on the processing and marketing of a given product, but including as a responsibility of the enterprise the provision of technical assistance, credit, and inputs to the farmer. This concept is given form in the treatment of cacao, tea and rubber. (See Section B of Chapter V for details).

The fifth strategy component relates to marketing. The basic premise here is that no production line will be recommended for promotion and development unless there is reasonable evidence that a profitable market exists for the product. This concept applies to both current lines of production and new crops to be introduced into the region.

A sixth strategy element is to look closely at places in the food system where losses occur and where remedial action could result in increased income to the producer. It is sometimes much quicker and economical to increase income by reducing a loss or wastage factor than by increasing productivity. The findings and recommended actions in this regard can be found in Sections B, G and H of Chapter V.

The seventh strategy element has to do with the administration of the AID supported program and, more broadly, with the administrative arrangements for the development of the region. We recommend that these tasks be entrusted to an autonomous or semi-autonomous Area Development Authority that is located in Villa Tunari and can deal with implementing agencies and/or contractors directly at the

local level. Alternative ways and conclusions as to how to accomplish this aspect of the program are discussed in Chapter IV.
An eigth strategy component has to do with the farmers organizations presently existing in the Chapare (the so-called sindicatos, centrales and the regional federation). We have made two findings in this regard: (a) This social structure (described in Section A6 of Chapter III) is ideally suited as a device for interracting with farmers in groups whether for technology transfer, cooperative promotion or other ends; and (b) Farmer cooperation, initial acceptance, and support for whatever innovations it is desired to introduce into the region are to a very large degree contingent on endorsement of those innovations by the elected officials of the various levels of the system. Consequently, the proposed strategy is to design ways and means of working with and through the farmer organizational network wherever possible.
Ninth amongst the general strategy considerations is the desirability of promoting a nucleation of the population, to the extent feasabile, into growth poles, i.e. into population concentrations where services can be provided on an integrated basis and where product collection centers, credit facilities, agro-industries, etc. can be established. It is primarily because of this element of the strategy that investment in potable water systems linked to provision of hydro powered electricity is built into the proposed investment program (See Chapter III J for details).
There are two additional program design questions of a general nature to which we have given consideration. The above nine general strategy considerations are applicable to any of the alternatives.

The first issue is whether the investments recommended should be programmed for only selected micro-zones in the region. To some extent this issue derives from the IICA/IDB and MACA/ INC/CORDECO-OAS separate project designs, respectively, for the so-called directed and spontaneous colonization areas. We can find no justification for this or any other fragmented approach to development of the region. Some services, e.g. research, extension, and credit cannot realistically be designed except on a region wide basis. Furthermore, the political implications of a spacially selective approach do not bear serious consideration.

The second general program design question was whether, as regards the current situation in the Chapare, the investment program should concentrate on improving existing settlement areas versus opening up new areas. We believe that the emphasis should clearly be on the former. It is here that the maximum benefit to the largest numbers of people can be obtained by the proposed program over a 5 year time span. We should make clear, however, that this recommendation is not intended to be interpreted in a rigid fashion, i.e. that only those families engaged in farming a plot of land on a fixed date are eligible for the benefits of the program. Spontaneous colonization is a continuous, dynamic process in the Chapare. Thus, as colonists push out into new settlements, the administrative micro-regions should be expanded (new administrative micro-zones are not necessarily called for) to provide services, including roads, to the new settlements. Another way of putting it, is that we recommend that, in general, services follow rather than precede new homesteading and that the homesteading be

of a spontaneous rather than a directed nature. The record in the Chapare is very clear as to the long run relative benefits and the results of spontaneous versus directed colonization.[2/] If there is to be any attempt to open up new areas it should probably be limited to building the penetration road and announcing that land for titling is available.

One final matter as concerns strategy: As the following Chapters will reveal, we are proposing a 5 year investment program (1981-85). The reason for this arbitrary time period is, on the one hand, our understanding that this is the maximum period for which AID can make commitments for a given project and, on the other, the difficulty of peering too far into the future in terms of programming expenditure. We wish to point out, however, that 5 years is a very short time period in which to hope to get a general development process well underway in a region so backward and beset with problems as the Chapare. Thus if AID and/or other donors and the Bolivian Government decide to accept the recommendations of this report and initiate a 5 year investment program along the lines indicated, we believe that they should take the decision in full awareness of the probable need for a further phase or phases of investment and consolidation.

2/ It should be noted that historically, in the short run, there has been less tendency to plant coca initially in areas settled by directed colonization, primarily because the need for cash income was less urgent than in spontaneously colonized areas. However, the "directed" colonists are now catching up with the spontaneous homesteaders in this regard.

III. DIAGNOSIS OF SITUATION

A. DESCRIPTION OF THE REGION

1. Physical and Ecological Characteristics.

- Location and Land Area.

The Chapare is one of the 14 provinces of the Department of Cochabamba. It is also the name given to an ecological classification within the country covering the subtropical portion of the Chapare province and part of the Carrasco and Arani provinces of the Department of Cochabamba (See Map No. 1). According to data of the "Proyecto Chapare" the land area of this ecological region has been estimated at 2,450,000 hectares. This estimate (which defines "sub-tropical" as the area under 500 meters above sea level) 1/ does not include the colonized area of Espiritu Santo, Locotal and Tablas Monte, of the Chapare province, with an area of approximately 40,000 hectares. Although the Espiritu Santo-Tablas Monte micro region is situated within the Cordillera at an altitude of about 1,500 meters above sea level, its settlement pattern is similar to other areas of the Chapare, and it is contiguous to them. We believe it should be included and thus arrive at a total area of approximately 2,490,000 Has. as the jurisdictional universe of the region under consideration. The project area, i.e. the area settled by small farmers is considerably smaller and totals approximately 147,000 hectares.

1/ MACA-INC-CORDECO/OEA: "Proyecto Chapare Propuesta de Estudio para el Desarrollo Integrado. Planificación Fisico-Espacial. Alternativa de Ocupación Territorial", 1978, p. 10.

- Landforms

The Chapare is dominated by two types of landforms: low hills and alluvial plains. 2/ The alluvial plains, composed of sedimentary materials of recent origin, are of two distinct types: alluvial fans which fringe the base of the high Cordillera Oriental, and the vast flood-plains lying in between the numerous rivers that flow northward into the Amazon region. The average elevation of these plains is about 300 meters above sea level. The low hills form a narrow area of transition between the Yungas (Deep V-Shaped valleys), a part of the high Cordillera Oriental rising some 5,000 meters, and the alluvial plains which sweep toward the Amazon region.

- Soils.

The soils in the Chapare are of recent origin. They are clay based but vary considerably in quality ranging from the rich alluvial soils along the river beds, to poor heavy soils further inland. "These soils are azonal with immature profiles having been formed mainly through the process of sedimentation. The typical profile consists of coarse gravels, overlain by deposits of sand, clay and silt, with a thin layer of organic material". 3/

Erodability, excessive moisture in the soils due to seasonal flooding, rapid loss of fertility through leaching, bad drainage, acidity, and lack of organic

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2/ Henkel, Ray: "The Chapare of Bolivia: A study of Tropical Agriculture in transition". Ph. D. Dissertation, University of Wisconsin, 1975, p. 15.

3/ Henkel, op. cit. p. 26.

materials are some of the main factors limiting agriculture in the Chapare. 4/

- Rivers.

Several rivers with their numerous tributaries run through the Chapare. These rivers are from west to east, the Rio Sécure, the Rio Isiboro, the Rio Chapare and the Rio Ic ilo. All of these flow northward across the Chapare, joining the Rio Mamoré which is part of the Amazon river system. These rivers with their changing beds during the rainy season are the dominant features of the Chapare landscape and are of great importance in the formation of the alluvial plains.

The changes in rivers channels, usually associated with floods caused by heavy rainfall during a short period of time, are sometimes dramatic and disastrous, cutting through the necks of the meanders, and destroying crops, plantations and villages. To illustrate this point, one can recall how in 1946 the Rio Chapare completely abandoned its former course below Villa Tunari giving rise to the Rio 24 which obligated the farmers along the road to Todos S[illegible] their land. In 1963, the Rio Chapare returned to its [illegible] course, but in 1967, it changed its course once more, destroying almost completely Todos Santos, which was the most important trading center of the Chapare region. A few years later, Todos Santos was completely abandoned and closed to river traffic and was replaced in its functions by

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4/ Marcial Macias: "Caracteristicas Fisiográficas, Suelos, Aptitud y Uso Actual de la Tierra", en Seminario sobre Desarrollo Agropecuario del Chapare, Memoria 1978: p. 34-35.

Puerto Villarroel, which is now the main trading center of the area linking the Beni to the Cochabamba region. Although the Port of Todos Santos does not exist any longer, the colonists stayed on their land even though they are cut off from the rest of the Chapare part of the year because of flooding.

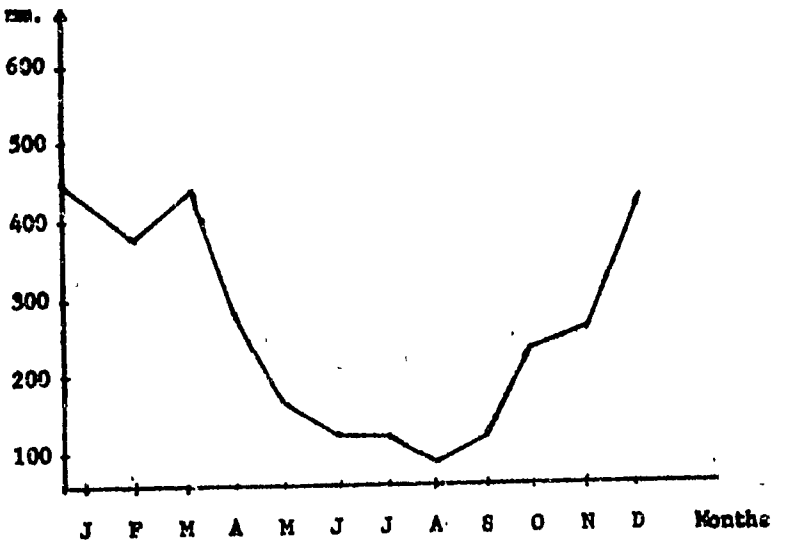
- Climate.

The climate is best summarized by Henkel [5/] when he states that "a tropical rainforest climate characterized by high temperature, high humidity and excessive rainfall prevails throughout the Chapare". Using monthly averages the temperature ranges between 19.2 and 27.6 °C. The annual average which varies from micro-zone to micro-zone is between 20 and 24 °C. It should also be noted that there are short periods of a few days when cold southern winds reach the Chapare (known as the Surazo) during which the temperature may fall as low as 7 °C.

The average rainfall at Todos Santos is around 2,900 mm., but in Villa Tunari it is approximately 4,733 mm., in Chimoré 3,952 mm. and in Chipiriri 4,415 mm. Although these villages are only 20 to 30 Km. from each other, they belong to different micro-regions characterized by significant differences in their bioclimate. The above figures are annual average figures, with a range over a ten year period of 2,041 to 4,270 mm. for Todos Santos: of 2,526 to 6,995 mm. for Villa Tunari: of 2,166 to 4,663 mm. for Chimoré and from 3,438 to 5,083 mm. for Chipiriri.

5/ Henkel, Rey: op. cit. pag. 31.

Most of the precipitation falls during the four month period December to March as can be seen from the following graphic representing a 15 year average (1952-1967) at the Metereological Station of Todos Santos. 6/



It is also worth noting that the rainfall in a given micro-region can be increasing at the same time that it is decreasing in another micro-region a few kilometers away. This is shown on the following graph which uses 1958 data for Todos Santos and Villa Tunari. 7/

6/ Adapted from: DESEC (Centro para el Desarrollo Socio-Economico), "Estudios Socio-Económicos del Chapare", 1968, 2nd. Edition, 1979, pg. 17.

7/ DESEC, op. cit., pag. 17.

- Vegetation.

The vegetation of the Chapare is characteristic of a dense tropical rainforest, with numerous species of trees, shrubs, vines and other tropical plants. Two distinct types of forest are differentiated locally; a low forest (monte bajo) and a high forest (monte alto). A subdivision is often made in the high forest category, differentiating between the second growth high forest and the virgin forest (monte virgen).

The "monte bajo" occurs where second growth vegetation has invaded man made clearing. The "monte bajo" category is normally used for second growth of 1 to 8 years in age. Numerous shrubs and low bushes are found below the trees.

The "monte alto" is second growth vegetation, aged 8 to 30 years, in which there is a tendency for shrubs and low bushes to disappear, so that one can easily walk beneath the tree canopy.

The "monte virgen" has characteristics of the "monte alto", but with a somewhat different variety of tree.

In the river channels, meander scars, and curichea (swamps) transitional types of vegetation are found. In the large sandy beaches of the river beds, the most common plant found is cuchi (Cinerius sasifatum), a tall plant similar to cane. Totora red (Malschuchate Totora), arrow grass (Cinerium sacaroidea) and cortadera grass (Paspalum angustifolia) are characteristic of the seasonally flooded depressions and back swamp areas behind the natural levee.

The savannah, situated North of the colonized area, are plains which are partly flooded during the rainy season. Pastures usually cover these soils, offering a good potential for livestock. The most common grasses found are "arrocillo" "gramalote" and "canuelas". Among the legumes which are found on those plains, the most common are Desinodium sp. and Crotolaria sp., both with good protein content.

The swamps, which are found mainly in the Savannah, are a refuge for fauna and aquatic flora of all kinds.

- Fauna.

The forest contains numerous species of monkeys and tropical birds, including parrots (Amazona farinosa and Ara sp.). Wild turkeys and numerous species of

wild duck are hunted for food. Other food animals: the tapir, capihuara (Hidrocoerus capibara), Jochi (Agouti paca, a small rabbit like animal), venado (a small deer) taitetú (Pecari tajacu) and chancho del monte (pecaria sp. a wild pig) are common in remote areas. Predators, such as jaguars, pumas, foxes and a small tiger type animal, along with wild cats and comadreja (Dedelphia marupialea), are also found.

The rivers are abundant in numerous species of food fish, particularly the pacu (Colossoma nitreii) and surubi (Pseudoplostitoma corrscans). Other fishes commonly found in the rivers are the Dorado (Salminus maxillosus), Sábado (Prochiludos platensis) and Palometa de agua dulce (Serrasalmus marginatus).

2. Actual and Potential Land Use.

The 2,490,000 hectares of the Chapare region as defined above, can be divided in terms of actual land use into four categories:

	No. Has. 8/
- Land occupied by colonists	147,000
- Land granted in large public and private concessions (almost entirely forest covered, but approximately 50% is considered potentially suitable for agriculture).	200,000
Isiboro-Sécure National Park (mostly forest, but includes approximately 150,000 hectares of land suitable for agriculture and some savannah land suitable for grazing).	900,000

8/ The data in this table, especially the estimates of potential agricultural and grazing lands falling into one or another of the groupings is based on interpretations of the data presented in Marcial Macias "Caracteristicas Fisiográficas" op. cit. and "Proyecto Chapare: Informe No. 2, Relevamiento Exploratorio de Suelos", Cochabamba, 1978.

- Unassigned lands in the Public Domain (approximately 40% is savannah potentially suitable for grazing; the remainder is in forest, of which 50 - 60,000 hectares are considered suitable for agriculture).	1,243,000
TOTAL	2,490,000

The above breakdown while admitedly very crude, illustrates several points: there is still considerable land area suitable for colonisation within the public domain. Nevertheless, because of the direction of new road building, nature of the soils, etc., there is already evidence of spontaneous colonisation pressure on the potential agricultural land in both the National Park and the large concessions (which are largely unexploited).

It seems likely that the south western limit of the park will have to be redefined to take account of this phenomenon and that the concession area will shrink over time if the owners do not take steps to develop their properties in the near future.

All of the savannah lands, both within and without the park area are a very long distance from present settlement and the existing road network. It will probably be a long time, under present planning criteria, before these lands are put into use. Nevertheless, in terms of the long run potential for the region they should be kept in mind.

3. The Colonisation Process.

As indicated above, the colonised area amounts to approximately 147,000 hectares divided into between 11,000 and 11,500 farms as of October, 1979. There is a somewhat smaller number of farm families since an unknown number of colonists

own or exploit two or more farms. Best estimates of the number of families is 10,500. 9/ The number of farms is changing constantly in an upward direction as spontaneous colonization proceeds.

The farms may be divided into two groups: those that were established under so-called "directed" colonization procedures and where the farm size is 20 hectares; and those that were established under spontaneous colonization and where the normal farm size is 10 hectares. The reason for the differentiation in size appears to be a function of the criteria of the separate agencies handling each group of colonists. There is no rationale of any sort in support of one or the other practice. Neither is there any significant difference today between one group and the other, since a large part of the original "directed" colonists abandoned the land and were replaced by "spontaneous" colonists, who have imposed their organizational forms (sindicatos) in replacement of the cooperative structures initially installed by the Agency in charge of directed colonization.

- Spontaneous Colonization.

Spontaneous colonization is the oldest form of colonization of the Chapare, dating back to 1922, with the opening of the first road linking Cochabamba to Todos Santos, the first national colony of the Chapare created by a government Decree of October 2nd., 1920. The spontaneous colonists settled along this road, creating the colonies of Paracti and El Palmar, in the 30's; Agrigento - Ibuelo and Busch in the 40's; and Chipiriri in the 50's. Also, spontaneous

9/ Newspaper reports dealing with the 1976 population census show 57,839 people for the Chapare province. We do not know wheter this was actual count, or a 1979 projection.

settlements progressively moved east of Villa Tunari, toward the Rio Ene, and to the north toward the Rio Isiboro. With the opening of a new paved road from Cochabamba to Villa Tunari seven years ago, there has been a significant increase in the number of colonies. There were 54 in 1967, 92 in 1972; 170 in 1978 and 183 in 1979.

The first colonies obtained authorization to settle through the "Jefature de Colonias" based in Todos Santos which was later moved to Villa Tunari. In 1961, this function was transfered to the Servicio Nacional de Reforma Agraria. Since 1973 the Instituto Nacional de Colonizacion, a descentralized agency of the "Ministerio de Agricultura y Asuntos Campesinos (MACA)", has been in charge of regulating land holdings.

- Directed Colonization

This form of colonization took place first in Chimoré and was then extended to Valle Ivirza and Valle Sajta.

The [illegible] settlement of 1,863 families in the Chimore area was financed under an IBD loan to the "Corporacion Boliviana de Fomento" granted in 1963. Considerable infrastructure, food supplies for the first year, and other benefits were envisaged. After the first year, 856 families abandoned the project.

In 1965, with the creation of the Instituto Nacional de Colonización, the concept of directed colonization was changed and instead of large government investment, it was decided to settle colonists in a "semi-directed" form consisting mainly of some technical assistance, the granting of a 20 ha. plot,

and facilitating the processing of a land title. This type of colonisation is typical of Valle Ivirza, Valle Sajta and the area of Chasqui, along the road to Puerto Villarroel.

The following table summarises the breakdown amongst the 3 types of colonisation.

Table III A-1

Distribution of Farms and Land Area by Directed and Spontaneous Colonisation

TYPE OF COLONY	No. OF COLONIES	No. OF FARMS	APPROXIMATE No. OF HECTARES
Spontaneous	117	8,281	82,810
Semi-directed	42	1,972	39,440
Directed	24	1,193	24,260
TOTAL	183	11,446	146,510

Table III A-2

Types of Colonization in the Chapare Area

CENTRALES	TYPE OF COLONIZATION	NUMBER OF SINDICATOS	NUMBER OF MEMBERS
1. Espiritu Santo	Spontaneous	8	423
2. Tablas Monte	"	8	262
3. Locotal	"	5	214
4. Villa 14 de Septiembre	"	14	1,573
5. 2 de Agosto	"	5	437
6. Bolivar	"	3	228

7.	Paractito	Spontaneous	14	659
8.	Ibuelo	"	9	739
9.	Etcerazama	"	4	384
10	Lauca Ete	"	7	333
11	Litoral	"	11	999
12	Sucre Isinuta	"	7	490
13	Todos Santos	"	6	388
14	Chipiriri	"	8	587
15	Germán Busch	"	8	565
16	Valle Sajta	Semi Directed	8	449
17	Valle Ivirza	"	18	788
18	Ivirgarzama	"	7	581
19	Puerto Alegre	"	9	354
20	Chimoré	Directed	11	499
21	Mariposas	"	3	360
22	Molga	"	10	434
	TOTAL		183	11,446

Source: PRODES: Regional Office, Villa Tunari, 1979.

- Settlement Pattern.

The colonized area of the Chapare is characterized by the absence of villages, or at least, the absence of the compact farm village typical of the highlands. Instead, linear patterns of settlements, reflecting the inflence of roads, prevail throughout the region. The basic unit of settlement is the individual family farm. A colony consists of a number of such farms, organized into a

sindicato. As B. Delaine comments in his study "Coca Farming in the Chapare Bolivia: A Form of Collective Innovation", in a directed colony the government first opens roads, and delimits the plots of land to be granted per family: usually a 20 Ha. plot.

In a spontaneous colony, the size and dimensions of the farm are established by the national Colonization Institute (INC) in making the initial land grants. Then the sindicato distributes the land to new comers giving generally 10 Ha. to each new colonist. The plot is usually 100 meters wide and 1,000 meters long, the long dimension of the farm extends inward from the road of access. Only 100 meters are chosen for the width, to allow a large number of colonists to have access to the road frontage, since settlers commonly build close to the road. When there is no more frontage available on the original road, additional rows of settlements are established behind the first one, following the same pattern. Some colonists having land on the first tier get another lot on the second tier, and sometimes even in the third tier. In Villa 14 de Septiembre, 6 files of settlements have been established. Access roads are constructed from the main road into the interior, but the number of such roads which can be built each year is limited. This places the colonists of the last tiers at great disadvantage for commercializing their products, due to transportation difficulties.

- Sub-division of Farms.

In the directed and semi-directed colonization areas, sub-division of farms is not permitted. While under Agrarian Reform law, the same principle applies to spontaneous colonization farm units, the civil courts which deal with

inheritance questions have permitted the practice. The result, according to a recent study 10/, is that 5.5% of the spontaneous colonists live on a plot smaller than 5 Has. and 26.4% on a plot between 5 and 10 Has.

4. Concessions.

In addition to the land granted to colonists the Instituto Nacional de Colonización has granted a number of concessions to various cooperatives, private enterprises and to agencies interested in the exploitation of the area.

These concessions of land have varied from 100 Has. to 104,000 Has., with an option for an additional 100,000 Has., as was the case in the initial grant to the Agro-Industrial Cooperative Copaico. Some concessions revert to the public domain and the land is redistributed to colonists, when, as it is often the case, these societies do not fulfill their development obligations.

The most important of these concessions are:

- COPAICO 104,000 Has.

(Cooperativa - Agro-Industrial Cochabamba). Members are from Cochabamba and other cities, who invested some money in the cooperative, without knowing the area. No development has taken place and the cooperative is largely inoperative at present. According to newspaper accounts, there may be problems concerning the management of investor's funds.

10/ Crowder and Delaine: "Communicación en el Chapare", UPLA-PRODES, La Paz, 1979.

III A-16

- CORDECO. 26,500 Has.

Corporación de Desarrollo de Cochabamba. A state agency for the development of the Cochabamba department. Again, no development has taken place to date.

- ROMECO. 8,000 Has.

Project for buffalo raising, run by the Institute of Colonisation. Discussions of a joint venture with a private Italian firm were undertaken, but have been discontinued. No development of the area at present.

- PROYECTO BUFFALO. 20,000 Has.

Project for buffalo raising, run by the National Institute of Colonisation. It actually has a herd of 130 buffaloes.

- CONCESION ROMA. 7,100 Has.

No information available.

- UNIVERSIDAD MAYOR DE SAN SIMON. 10,500 Has.

This a development project run by the University of Cochabamba. They have a small experimental station in Sajta and have begun development work, including installing a saw-mill, improving pastures and bringing in livestock.

- COOPERATIVA LITORAL SAJTA	10,000 Has.
No information available.	
TOTAL	186,100 Has.

The total area in private and public concessions comes to approximately 200,000 Has. The remainning 14,000 Has. are divided amongst approximately 300 concessions, where allotments run between 100 and 1,000 hectares.

5. Cooperatives.

Production "Cooperatives" in the Chapare were organized primarily in order to obtain land, and are of three main types:

1. Farmers, with 30 - 40 members each.
2. Institutional, composed of city people, and holding land primarily for speculative purposes (The University, Luz y Fuerza, COPAICO, Agrotech, etc.).
3. Mixed, composed of townspeople and farmers (e.g. the cooperative of Chipiriri, Santa Ana, Copacabana, Gualberto Villarroel).

Although the land held by the first and third type of "cooperative" is worked individually, title is granted collectively. For the third type of cooperative the main problem has been that not all the members were farmers, some were transportista or other intermediaries and they failed to fulfill their obligations to work the land in common or hired a peasant to do the job. The situation regarding the second group is covered under the section above on concessions.

At the moment, the farmers are not predisposed in favor of production cooperatives, rather the opposite. Between 1963 and 1965 the INC, as part of its directed colonization effort, put together a large, multi-purpose cooperative called Chimoré Ltda., which included non-farmer members. Its total membership was about 1,000. The cooperative obtained credit in the farmer's name, owned tractors and even a rice mill in Villa Tunari, but later went bankrupt. The Bolivian agricultural Bank (BAB) foreclosed the loan in 1973-74 and sold off the assets. Although many of the farmer cooperative members have left the Area, the few remaining are still making payments to BAB for their share of the loan to the Cooperative. If they stop making payments, they lose their eligibility for further BAB credit.

FENCA has been active in establishing an Agricultural Cooperative Center of the Chapare in Villa Tunari by offering to finance commercialization and mechanizacion of local production; so far they have been instrumental in supplying 5 threshing machines.

In 1977, the Bolivian Institute for Research and Extension (IBTA), the National Cooperative Institute (INALCO) and the National Community Development Service (SNDC) signed a national and regional agreement to coordinate the cooperative movement; INALCO was to be responsible for controlling the economic aspects of cooperative activities. To date, nothing has been done in the Chapare along these lines.

There are a few savings and loan and consumer cooperatives with limited membership which appear to be functioning satisfactorily. The credit unions have been sponsored by the Catholic Church and are receiving some limited assistance

from the National Credit Union Federation (FENACRE). The 3 consumer cooperatives, all of which are located in Valle Iriria, are sponsored by DESEC.

Church affiliated organizations assist some settlers to form groups that have legal status that are similar to pre-cooperatives. One that appears to be doing well is Equipo Chapare, located at Lauca, with a crop and forage production program. It is assisted by the United Methodist Committee with an on-site US technician supported with grant funds for administration, materials and supplies As a group, Equipo Chapare has obtained supplier credit to purchase machinery for a rental pool to members for land clearing and preparation, forage harvesting, baleing, etc. Other equipment has been donated. Thirty settlers (others are joining) have committed 5 hectares each for a period of 5 years for the production of corn and kudzu. 50 hectares have been cleared with 10 planted to kudzu and 40 to corn. The US technician working with this group also assisted the formation of a livestock association in the Chimoré area so that members, about 100, could obtain better health care for their animals by the use of medicines and vaccinations. This health care is now being provide by the animal sanitation service of the Ministry of Agriculture.

The Catholic Church's CARITAS has assisted settlers to form an association of 5 groups of tomato growers with 9 members each. Each group worked one or two hectares as a common area to produce tomatoes. CARITAS provided credit at below market rates for seeds, tools, sprayers and chemicals. The groups were collectively responsible for the credit. Unfortunately at market time, prices were low and income did not cover costs. The groups are no longer producing tomatoes and are becoming part of Equipo Chapare for the production of forage.

CARITAS has not yet decided how it will handle the outstanding loans for the tomato production.

While small cooperatives, groups and associations have not yet had any significant impact on the social and economic development of the area, there appears to be a willingness to use them, with expectations of success, when they are assisted with the right mix of capital and technical assistance.

6. Sociological Analysis of the Area

The colonists who settled in the Chapare, either under directed or spontaneous colonization, are not typical peasant farmers, but rather form a special selected group of farmers, considering their age, education and sociological variables, such as a sense of control over personal destiny and openness to change.

- Origin of Colonists and Family Composition 11/

The great majority (70,36% of the Chapare colonists come from the temperate valleys of Cochabamba, 8.91% from Potosi and 2.63% from Chuquisaca) emigrate as a consequence of population pressure in the areas of origin. One consequence of this migration pattern is that the new settler is not trained in tropical agriculture, and has to learn it from his neighbors , once settled. 59% of the colonists have settled in the Chapare in the last ten years, which shows the attraction that this region represents for many farmers.

11/ The data of this section are taken from PRODES's study: "Estudio de Necesidades Sentidas en el Chapare" 1978 and from Crowder and Delaine's study "Medios de Comunicación en el Chapare" 1979. For more details one can refer to those two studies.

Nearly 80 percent of all colonists are married or live with a person of the opposite sex and have family. Wives usually come from approximately the same places as the male settlers.

The average family size is 4 to 5 members. The heads of the family average 34 years of age, with a distribution of 37 percent below 30, 33% between 30 and 39 years, 20 percent between 40 and 49 and only 10 percent above 50 years. In sum, a relatively young population.

- Education of the Settlers and their Families

The Chapare farmers can be considered as a selected group of farmers, as they have high literacy rates and educational levels: only 17.59% do not know how to read and write; 73.61% received basic education, which means that they went to school for a minimum of 4 years. This is considerably better than the 70 percent illiteracy rate for the population at large in Bolivia. In terms of educational level, 7.41% of those having formal education attended high school, and 1.39% percent attended some technical school

The children of the colonists have better school oportunities than most children in rural areas. Nearly 50 percent of the sindicatos have a school with one or two teachers.

These schools are in very poor condition and lack didactic material, but it is important to note that more than 85 percent of the farmers send their children to school. Community labor and materials are used to build schools in sharing arrangements entered into with the Servicio Nacional de Desarrollo de

la Comunidad, and with the Farmer's Federation.

There is also an Escuela Normal Rural in Chimoré which was created in 1972 to produce teachers who could relate to the needs of the region. However, it is reported that the majority, once graduated, leave the area.

- Language and Religion

Another important indicator that the colonists are a select group of farmers is the language spoken. Although 85.65% are native quechua speakers, 87 percent commonly communicate in Spanish. This is obviously related to their educational level, since formal education is given only in Spanish. As to religion, 88.16% are Roman Catholic, which is consistent with the official and traditional religion of the country. Catholic churches have been built and priests and nuns have their residency in Villa Tunari, Chipiriri, Chimoré, Valle Ivirza and Puerto Villarroel. The second group of importance are the Evangelists who have settled in Chimoré and are characterized by an ascetic way of living, e.g. tobacco and alcohol are prohibited.

- Social Activity

Due to the absence of villages and the dispersion of the population all over the colonized areas, social activity in the Chapare is very limited. People are isolated from each other, meeting weekly on Sundays when they go to the markets in larger villages, and monthly for the sindicato meeting. Beer and chicha (maize beer) are always available on market days and for any special celebration. Since chicha cannot be kept for more than few days without spoiling, it is common for the farmers to drink until the barrels are dry.

The excessive consumption of alcoholic beverages in the Chapare, by both men and women, constitutes a serious social problem [12/].

There is a tendency for a large number of women to participate in social activities such as mother's clubs, which have been created by the nuns living in the areas, or by auxiliary nurses. About 25% of the colonies have a mother's club. In these meetings, they are taught rudimentary skills, e.g. how to take care of their babies, how to give them a balanced diet, and how to keep them clean. Women who participate in such activities receive from CARITAS some food, such as milk, flour and edible oil.

- Social Organization

The basic social organization in the Chapare is the "Sindicato", which is a kind of holistic civic organization. Each individual colony is organized as a sindicato. The two are synonomous. A sindicato (or colony) is directed by a secretary and a committee elected by popular vote. The main positions are the Secretary General ("Dirigente"), the Secretario de Relaciones, Secretario de Actas, and Secretario de Cooperativas de Agricultura, de Viabilidad, de Salud, etc., but these last functions are more nominal than real.

The Sindicatos (actually 183) are grouped into Centrales (23) which are also administered by secretaries and committees elected from among the leaders of the local sindicatos by popular vote.

12/ Delaine, Bernard: "Coca Farming in the Chapare-Bolivia. A Form of Collective Innovation," Ph. D. Dissertation, St. Louis University 1979: pg. 86-87.

These Centrales are grouped in what is called the "Federación Especial Agraria del Chapare Tropical", which meets monthly. As Henkel notes: "the sindicato leaders meet once a year to choose a regional secretary from the Chapare to represent them at national meetings. The regional secretary becomes the official spokesman for the sindicatos of the Chapare. As such he commands significant authority in the implementation of government policy at the local level and frequently may exert considerable inflence at the national or departmental level. It is he who decides policy for the Chapare in regard to taxation, development projects, and a variety of other national and local governmental programs. He also approves or disapproves of policies of the national government or the departmental government that may affect the colonist in the Chapare". 13/

The members of each sindicato usually meet on a monthly basis to decide policy and plan programs within the colony, to approve requests for land, to process land titles, and eventually to settle disputes among its members.

Henkel again states that: "During the regular monthly meeting work assignments are made with each member being required to contribute from one to three days to various projects within the colony, such as building roads, clearing trails, and maintaining the building and grounds of the school.

"Failure to complete the assigned tasks may result in expulsion from the colony. The local secretary with the elected committee members also frequently sit as judge and jury to hear and settle a variety of disputes that arise among the

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13/ Henkel, op. cit. pg. 80.

colonists. The sindicato committee may punish members for a variety of minor offenses ranging from bad conduct to petty thievery. The punishment usually involves banishment from the colony and loss of land. In the event a member is expelled from the colony, his holdings are given without payment to a new colonist who wishes to settle within the area". 14/

- Role of Women

The women's role in the Chapare is very traditional. In addition to the culturally defined functions of takingcare of babies and domestic work, they often assist their husbands in coca harvesting and, sometimes with harvesting of rice, corn, and bananas. But more often they only help in drying coca leaves. In sum, their direct participation in the production process is limited they do participate in decisions concerning the management of the farm and exert a degree of influence on their husbands in this regard. Usually, they take charge of the money of the family and have some influence on how it is spent.

Aside from their participation in child care groups and similar organizations, women have litle to do with the social and civic organizations of the community. For example, there is not single women who at present is an officer in the farmer's associations (sindicatos, centrales or the Federation). They can represent their husbands when the latter cannot attend a meeting, but their role is generally passive. They can be members of a sindicato when they are the head of family.

14/ Henkel, op. cit. pg. 81.

There has not been much investigation regarding the status and problems of women in the Chapare, nor of the opportunities for enhancing their role in the development process. Such studies are a necessary prerequisite to any program development.

Sociological Characteristics of the Population

Peasant farmers have generally been described as living in a cultural world distinct from society as a whole. Their goals and values are supposed to focus on tradition. As such they have been seen as a social force opposed to change. This traditional image of the peasant does not fit the Chapare colonist, who wants a better rural life for his children than he has had. Not just a better life but a better life in his rural community, even though his children may not be greatly attracted toward this life.

The colonists place an extremely high priority on the community and its improvement, as evidenced by their participation in communal work. One is expected to serve, even when it is not convenient for him. Being elected a sindicato leader is time consuming and not economically rewarded; however, no one can refuse to serve.

To achieve these key goals of a better rural life, and of improvement in the rural community, the colonist wants change. He has already taken one great decision; to abandon, at least temporarily, his community of origin, his friends and relatives, to settle in the Chapare. It is characteristic of a great majority of the Chapare colonists that they want access to information about agriculture, to commodities such as herbicides and pesticides, and to credit. They spend much energy seeking information that often they cannot

get. They often express a desire for rural newspapers and publications which could give them information on their plantings. A recent study reveals a strong felt need for a regional radio station in the Chapare, which was programed to provide them with rural development information.

Another point of interest is the colonists' general sense of control over their personal destiny. Not only do they claim that they are better off now than in their community of origin, but also express confidence in themselves and their sindicato. They believe that they can succeed and are confident that they can improve their situation. They are open to suggestions, but they also are eager to contribute ideas of their own. In one instance, when it was proposed that an extensionist work in a sindicato, the members decided to build a house for him, to make sure that he would be able to stay and work with them.

All of the above considerations are very positive and it is reasonable to conclude that there is receptivity to change and that the unavoidable disruptive effects of change will be minimized when it is desired by the community at large. If the colonists through their sindicatos are invited to participate in the planning and implementation of the changes, no serious social problem will result from these changes.

7. Micro-Regions 15/

As was indicated in the strategy section of this report, it is believed necessary to undertake planning at the micro-regional level. For this purpose, we

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15/ Annex No. 1 provides a detailed list of the Centrales and Sindicatos located in each micro-region.

recommend dividing the Chapare into nine micro-regions (See Map No. 3) as follows:

Micro-region	No. 1	Tablas Monte - Locotal
"	No. 2	Espiritu Santo - Villa Tunari
"	No. 3	Chipiriri
"	No. 4	Isiboro - Litoral
"	No. 5	14 de Septiembre - San Francisco
"	No. 6	Paraiso - Todos Santos
"	No. 7	Ibuelo - Lauca
"	No. 8	Chimoré - Mariposas - Meiga
"	No. 9	Ivirza-Ivirgarzama-Pto. Villarroel

As can be seen, the micro-regions cover the entire colonized area of the Chapare. The principal criteria used in setting the bondaries between regions are as follows:

a) Entire "centrales" are incorporated into a given micro-region. No "central" is split between two regions. Conversely, a micro-region may contain 2 or more "centrales".

b) The area within a given micro-region should be relatively homogenous as regards soil conditions, hydrological and precipitation factors, and aptitude for a given number of agricultural product lines.

c) The micro-region should have a common road network or the potential for such a network

d) The population density, land area, physical conformation, road system, and existance of an urban growth pole should lend themselves to the micro-region being used as an administrative unit for such purposes as the

establishment of extension agencies, product collection points, and cooperative development.

The remainder of this section of the report is dedicated to providing a general description of each of the nine proposed micro-zones. Covered here are the following characteristics for each zone:

Physical and climatological aspects;

Demography and social organization;

Physical and social infrastructure;

Current and potential new production, and

Growth pole.

Detailed planning should be a function of program execution.

Micro Region No. 1

It covers the area of Tablas Monte and Locotal.

Physical and Climatological Aspects.

Following the system of zones of life elaborated by Holdrige, this area falls within the category very humid tropical forest, in transition to subtropical forest. The vegetation is characterized by a low to medium virgin forest and a low second growth forest. The topography is irregular, with moderate to strong slopes. The altitude varies from 2,200 to 1,700 meters above sea level. A humid sub-tropical climate prevails, with an average yearly precipitation level ranging from 2,000 to 2,500 mm. Soils with good potential for agricultural production are limited to the alluvial formations along the rivers. The soils of the slopes is very shallow, and does not have a good potential for agriculture

Demography and Social Organization.

The population of the area, which is located between Locotal and Tablas Monte, is composed of spontaneous colonists who settled between 20 to 50 years ago. They are organized in two centrales; the 14 sindicates which form these centrales have a membership of approximately 477 farms.

Physical and Social Infrastructure.

The communication infrastructure is rather poor, although there is a new 30 kilometer road from the paved road Villa Tunari-Cochabamba, to Tablas Monte. Most of the sindicatos which surround Tablas Monte have no access roads, or they are in very bad condition. The irregularity of the topography is a serious obstacle for opening new roads, or maintaing the existing ones. The area does not have any first aid centers or health facilities of any kind. The area has 7 sectional primary schools.

Growth Pole.

The village of Tablas Monte seems to be best indicated as a growth pole, being geographically at the center of the populated portion of the micro zone.

Current and Potential New Production

Out of 4,780 Has. of settlement of this micro-region, the area under cultivation is estimated at only 300 Has. Since the number of farms is estimated at 476, the average area under cultivation per farm is 1.65 Has., much lower than the general average for the Chapare, calculated at 4.3 Has.

The production pattern on this land, by order of economic importance, is as follows: Hot papper, corn, peanuts, vegetables, avocado and coffee.

No new production lines have been considered for introduction into this micro-region.

Micro Region No. 2

It covers the area between Espiritu Santo and Villa Tunari, and extends on each side of the paved road.

Physical and Climatological Aspects

This area is characteristic of a humid tropical forest in transition to very humid tropical forest. Three types of vegetation can be distinguished: the "caja del monte", formed by small brushes growing in the high part of the mountains; the "pie del monte" or high forest which grows on the lower reaches of the Cordillera; and the high forest, typical of the low plain. The topography is irregular, with incipient erosion. The altitude varies from 1,300 meters in Espiritu Santo to 350 meters above sea level in Paractito and Villa Tunari. A very humid subtropical climate prevails throughout the area, with an average yearly rainfall ranging from 3,000 to 4,500 mm.

Soils are relatively deep, varying from a clay texture to various types of loam. Simple erosion control measures are necessary when the land is farmed.

Demography and Social Organization

The population is mainly composed of spontaneous colonists who settled in the area 40 to 50 years ago. However, some of them are recent arrivals -within the past 5 years- who bought land from old colonists. They are organized in 22 sindicatos grouped into two centrales, with a membership of approximately 1,082 farmers.

Physical and Social Infrastructure

The communication infrastructure is very good, the population being settled on each side of the paved road Cochabamba-Villa Tunari, and on each side of the old road Cochabamba-Villa Tunari, in the area of Parectito. Parectito also has a potable water system which was installed less than a year ago and one first aid center. The area has a central primary school in Cristal Mayor, with 7 teachers, a high school in Villa Tunari, with 12 professors and a central primary school in Parectito with 18 teachers. One state hospital, and one private hospital are found in Villa Tunari, so that this micro-region is the most privileged one from the physical and social infrastructure point of view.

Growth Pole

Villa Tunari is the natural growth pole of the area, although Parectito also presents good characteristics as a potential growth pole.

Current and Potential New Production

Out of 10,160 Has. of settlement, the area under cultivation is estimated at 3,322 Has. Since the number of farms is estimated at 1,032, the average area under cultivation per farm is 3.1 Has., under the general average for the Chapare.

The production pattern on this land, by order of economic importance is as follows: coca, bananas, citrus, rice, yucca and avocados.

The new production lines which are agronomically feasible for promotion in this micro-region, and the centrales within the micro-regions, which are most adapted for these crops, are as follows:

Crop	Centrales
Tea	Espiritu Santo Paraestito
Rubber	Paraestito
Pejivalle	Espiritu Santo Paraestito

Micro Region No. 3

It covers the area of Chipiriri

Physical and Climatological Aspects

This area is classified as very humid tropical forest. The dominant vegetation is second growth forest, as a result of a large agricultural and lumber exploitation. The topography is mostly level with upper terraces which present some indications of landslides and erosion along the slopes. The altitude varies between 250 to 350 meters above sea level. A very humid subtropical climate prevails throughout the micro-region, with a yearly average rainfall of 3,500 to 4,500 mm. Soils are loam textured, with a depth ranging from 1 to 1.5 meter. They require liming and fertilization.

Demography and Social Organization

The population of this area is composed of colonists who settled between 40 to 50 years ago, supplemented by new colonists who have settled in the last ten years, forming new sindicatos. There are 8 sindicatos grouped in one central with a membership of approximately 587 farms.

Physical and Social Infrastructure

The communication infrastructure of the area is fairly good, except for the new sindicatos located around the Village of Chipiri.

Chipiriri has a large primary school with 22 teachers, and a state hospital with one medical doctor, one dentist, 2 nurses and 2 auxiliary nurses. There is also an experiment station engaged in livestock and forage production research.

Growth Pole

The village of Chipiriri, which is the headquarters of the central, is the natural growth pole of the area.

Current and Potential new Production

Out of 5,990 Has. of settlement, the area under cultivation is estimated at 2,280 Has. Since the number of farms is estimated at 587, the average area under cultivation per farm is 3.8 Ha., which is a little under the general average for the Chapare.

The production pattern on this land, by order of economic importance, is as follows: coca, rice, citrus, bananas and corn.

The new production lines, which are agronomically feasible for promotion in this micro-region and the Centrales within the micro-region which are best adapted for these crops are as follows:

Crop	Centrales
Tea	Chipiriri
Rubber	Chipiriri
Pejivalle	Chipiriri

Micro Region No. 4

It covers the area extending from Litoral to Isiboro, on the penetration road to the Beni.

Physical and Climatological Aspects

This area falls within the category of humid tropical forest. The vegetation is low to medium virgin forest, and a low second growth forest.

The topography is irregular, with moderate slopes of up to 2%. They show some signs of erosion. The altitude varies from 350 to 250 meters above sea level A humid subtropical climate prevails throughout the area, with an average yearly rainfall ranging from 3,500 to 4,000 mm.

Soils present a good potential for agricultural production, with a depth of more than 1.5 meters. They are loam textured and well adapted to seasonal production. However, they require some degree of liming, fertilization and soils management.

Demography and Social Organization

The population is composed of spontaneous colonists who settled in the area during the last ten years. They are organized in 25 sindicatos, grouped into 4 centrales having a membership of approximately 2,101 farmers.

Physical and Social Infrastructure

The communication infrastructure is fairly good from Litoral to Bolivar, but there are no access roads to the various sindicatos on each side of the Bolivar/Litoral road. A new bridge is being built across the Samusabety river, at the level of Bolivar, but one has to cross several large and deep rivers between Bolivar and Isiboro, so that this last section is totally isolated during the rainy season. There is one central primary school in Eteramazama, with 15 teachers, and 5 sectional primary schools in other sindicatos of the micro-region. A first aid center has been built in Samusabety recently.

Growth Pole

Eteramazama has been selected as a growth pole being geographically located at the center of the area.

Current and Potential Production

Out of 18,940 Has. of settlement, the area under cultivation is 7,915 Has. Since the number of farmers is estimated at 2,101, the average area under cultivation per farm is 3.8 Has., which is a little under the general average of 4.3 Has. for the Chapare as a whole.

The production pattern on this land, by order of economic importance, is as follows: coca, rice, citrus, bananas and yucca.

New production lines which are agronomically feasible for promotion in this micro-region and the Centrales within the micro-region which are most adapted for these crops as follows:

Crops	Centrales
Pineapple	Eteramazama
Tea	Eteramazama Bolivar Litoral
Rubber	Eteramazama Bolivar Sucre Isinuta Litoral
Pejivalle	Bolivar Sucre Isinuta Eteramazama Litoral

Micro Region No. 5.

It covers the area which extends between Villa 14 de Septiembre and Puerto San Francisco.

Physical and Climatological Aspects.

This area falls within the category of humid tropical forest, with a vegetation characteristic of a high virgin forest and second growth forest.

The topography is fairly level; the beginning of the flood plains which sweep northward to the Beni Basin. The soils are composed of unconsolidated sedimentary material of recent origin. These deep soils are clay loam, and sandy loam offering good potential for agricultural production, although they are subject to seasonal flooding. Some degree of liming and fertilization is indicated.

Demography and Social Organization

The population is composed of spontaneous colonists who settled in the area some 30 to 40 years ago. They are organized in 19 sindicatos, grouped into 2 Centrales, having a membership of approximately 2,010 farmers.

Physical and Social Infrastructure

The communication infrastructure is fairly good on the main road Villa Tunari-Villa 14 - San Francisco, but there are few access roads to the sindicatos. In Villa 14 there are presently six files of settlements and the roads of the last tiers are in very bad conditions during the rainy season. There is a central primary school in Villa 14 de Septiembre with 15 teachers, another in San Francisco, with 6 teachers, and a total of 11 sectional primary schools. Villa 14 has a first aid center attended by a physician, but he has practically no medical equipment.

Growth Pole

Villa 14 de Septiembre has been traditionally the trading and marketing center of the area, and as such it is the natural growth pole of this micro-region.

Current and Potential Production

Out of 17,270Has. of settlements, the area under cultivation is estimated at 11,730 Has. Since the number of farms is estimated at 2,010, the average area under cultivation per farm is 5.8 Has. which is far above the general average of 4.3 Has. for the Chapare.

The production pattern of this land, by order of economic importance, is as follows: coca, bananas, citrus, rice, corn and yucca.

The new production lines, which are agronomically feasible for promotion in this micro-region and the centrales within the micro-region, which are most adapted for these crops, are as follows:

Crops	Centrales
Cacao	Villa 14
Rubber	Villa 14
Pejivalle	Villa 14 2 de Agosto

Micro Region No. 6

It covers the area of Paruino and Todos Santos, which extends between the Rio 24 and the Chapuro River.

Physical and Climatological Aspects

This area falls within the category of humid tropical forest, with a vegetation characteristic of a low forest and second growth low forest. The topography is level, the typical profile consisting of coarse gravel overlain by deposits of sand, clay and silt, with a thin layer of organic material at the surface, derived from decaying leaves and other debris from the dense forest cover. Depressions are partially filled by sediments deposited during periods of seasonal flooding, and therefore offer a very good potential for agriculture. The average altitude is 250 meters above sea level, and the yearly rainfall varies between 2,500 to 3,500 mm.

Demography and Social Organization

Although the creation of Todos Santos dates back to 1922, the actual population of the area is of recent origin, since the oldest colonists have been evacuated

and relocated in other areas of the Chapare, after the changing of the course of the Rio Chapare in 1967, causing an abandonment of settlements along the road to Todos Santos. New colonists have settled in the area since then, and to the North of Todos Santos. Colonies of Yuracares were recently created.

The colonists of this micro-region are organized in 6 sindicatos grouped in one central, having a membership of approximately 388 farms.

Physical and Social Infrastructure

The communication infrastructure has been damaged by the seasonal flooding and the changing of the course of the Chapare river, which cut the road to Todos Santos. As a result, this micro-region is isolated from the rest of the Chapare from November to April, when no trucks can cross the Rio 24 due to the high level of the water.

Todos Santos had a state hospital until 1967, when the village was abandoned after being almost completely destroyed by the changing of the course of the river. At present, it has been converted into a first aid center. There is a central primary school in Paraiso, with 7 teachers, and 4 sectional primary schools.

Growth Pole

Paraiso which is also the seat of the Central of Todos Santos, is the most likely pole growth for this micro-region. It is actually the center of socio-economic activity in the area.

Current and Potential Use Production

Of 3,200 Has., of settlement, the area under cultivation is estimated at 2,000 Has. Since the number of farms is estimated at 388, the average area under cultivation per farm is 5.1 Has. which is far above the general average for the Chapare.

The production pattern on this land, by order of economic importance, is as follows: bananas, citrus, rice, papaya and yucca.

New production lines which are agronomically feasible for promotion in this micro-region are: cacao, rubber and Pejibaile.

Micro Region No. 7

It covers the area which extends between Agrigente A and the Lauca Eke River.

Physical and Climatological Aspects

This area is classified as humid tropical forest. The dominant vegetation is characterised by second growth forest, as a result of a large agricultural and lumber exploitation. The topography is almost level, with low hills which present some signs of erosion. The altitude varies between 250 to 350 meters above sea level. A very humid subtropical climate prevails throughout the area, with a yearly average rainfall ranging from 3,500 to 4,500 mm. Soils are deep, loam to sandy textured, offering moderate drainage.

Demography and Social Organization

The population of this area is composed of colonists who settled between 10 to 25 years ago. They are organized in 24 sindicatos, grouped into 3 centrales

having a membership of approximately 1,637 farms.

Physical and Social Infrastructure.

The communication infrastructure of the area is fairly good. However, the access roads to some sindicatos such as San Luis and Villa Fernandez need better maintenance in order to reach these places all year round. Ibuelo has a private hospital run by Catholic nuns and with a potable water system. Ibuelo also has a central primary school with 16 teachers. Another central primary school is located at Central Busch, with 12 teachers. The total number of seccional primary schools is 14.

Growth Pole

The village of Ibuelo is the most likely candidate for a growth pole, being at the center of the micro-region, and having basic social infrastructure such as a hospital and a potable water system.

Current and Potential New Production

Of 15,900Has. of settlement of this micro-region, the area under cultivation is estimated of 8,250 Has. Since the number of farms is estimated at 1,637, the average area under cultivation per farms is 5 Has., which is above the general average for the Chapare. The production pattern on this land, by order of economic importance, is as follows: coca, rice, bananas, citrus and yucca.

The new production lines, which are agronomically feasible for promotion in this micro-region, and the centrales within the micro-region, which are most adapted for these crops, are as follows:

Crop	Centrales
Pineapple	Lauca Ede
Cacao	Ibuelo
Tea	Ibuelo Central Busch Lauca Ede
Rubber	Ibuelo Central Busch Lauca Ede
Pejivalle	Ibuelo Central Busch Lauca Ede.

Micro Region No. 8

It covers the area between the Chixoré and Ivirgarzama Rivers.

Physical and Climatological Aspects

This area is classified as a humid tropical forest. The dominant vegetation is second growth low forest. The topography is mostly level, with upper terraces and low hills. The altitude varies between 250 to 350 meters above sea level. A humid subtropical climate prevails throughout the micro-region, with a yearly average rainfall ranging from 3,000 to 3,500 mm. Soils run from deep, clay areas to sandy loams, which are badly drained.

Demography and Social Organization

The population is mainly composed of directed colonists who settled in the area 15 to 20 years ago. The directed colonization in Mariposas and Melga dates back to only 5 years ago. The colonists are organized in 33 sindicates, grouped into 4 centrales, having a membership of approximately 1,347 farms.

Physical and Social Infrastructure

The communication infrastructure is generally good, since the access roads to the sindicatos were built by the Government before settling the population. However, very small bridges were never completed in the Chimoré area. In the area of Puerto Alegre and Mariposas the access roads are in very poor condition- so that transportation is very difficult during the rainy season. The village of Chimoré has a central school and a team of 19 teachers. Another central school is located at Mariposas, with 11 teachers. The sectional schools of the area total 7. There is also a Normal Rural School in Chimoré with 20 professors. A first aid center can be found in Chimoré with one medical doctor and an auxiliary. There are other first aid centers in Mariposas and Victoria, with an auxiliary.

Growth Pole

The village of the Chimoré, being the center of socio-economic activities of the area, is the most adequate growth pole.

Current and Potential New Production

Of 23,020 Has. of settlement, the area under cultivation is estimated at 5,420 Has. Since the number of farms is estimated at 1,547, the average area under cultivation per farm is 3.6 Has. which is a little below the general average for the Chapare.

The production pattern on this land, by order of economic importance, is as follows: rice, citrus, bananas, coca, corn and yucca.

The new production lines, which are agronomically feasible for promotion in this micro-region and the centrales within the micro-region which are best adapted for these crops are as follows:

Crops	Centrales
Pineapple	Mariposas Melga Puerto Alegre
Cacao	Chimoré Puerto Alegre
Tea	Chimoré
Rubber	Chimoré Puerto Alegre
Pejivalle	Chimoré Puerto Alegre Melga Mariposas

Micro Region No. 9

It covers the area extending from Valle Ivirza to Puerto Villarroel.

Physical and Climatological Aspects

This area is classified as a humid tropical forest. The dominant vegetation is characterized by a second growth low forest to virgin forest. The topography is irregular in the area of Valle Ivirza, with high hills and upper terraces. The area of Puerto Villarroel is characteristic of a flat flood plains. The altitude varies for the whole micro-area, between 500 meters and 250 meters above sea level. A humid subtropical climate prevails throughout the area, with a yearly rainfall ranging from 2,500 to 3,000 mm. Soils are deep, clay loams to sandy textured loams, with a good drainage.

Demography and Social Organization

The population is composed of semi-directed colonists, of recent origin. They settled in the area mainly in the last 5 years. They are organized in 33 sindicatos grouped into 3 centrales, having a membership of approximately 1,618 farms.

Physical and Social Infrastructure

The communication infrastructure is very good from Ivirgarzama to Puerto Villarroel, and from Ivirgarzama to Valle Ivirza. This last section has been completed this year. Access roads to the numerous sindicatos around Valle Ivirza are in very bad conditions, making difficult transportation during the rainy season. Puerto Villarroel has a hospital, and the first aid center of Valle Ivirza is run by a medical doctor. There are also primary central schools in Puerto Villarroel and Ivirgarzama with 27 teachers and a total of 3 primary sectional schools.

Growth Pole

The growth pole of this micro-region is Valle Ivirza.

Current and Potential Land Production

Of 44,860 Has. of settlement, the area under cultivation is estimated at 7,305 Has. Since the number of farms is estimated at 1,618, the average area under cultivation per farm is 4.6 Has. which is a little above the general average of 4.3 Has for the Chapare as a whole.

The production pattern on this land, by order of economic importance, is as follows: rice, coca, bananas, citrus, corn and yucca.

New production lines, which are agronomically feasible for promotion in this micro-region and the centrales within the micro-regions, which are best adapted for these crops is as follows:

Crops	Centrales
Cacao	Valle Ivirza Valle Sajta
Pejivalle	Valle Ivirza Valle Sajta Ivirgarzama

B. CURRENT PRODUCTION: PROBLEMS AND OPPORTUNITIES

The key to any long term improvement in the situation of the Chapare farmer is a change from his current production system, which is based on slash and burn brush fallow technology, to one where he utilizes all or most of his land on a permanent, settled basis.

1. Current Farm Production System

- Land Clearing

Land clearing is nearly always done in the three month period, June through August. Excessive rainfall during the other months severely restricts burning of the vegetation.

The clearing of the land is done in several steps. First, the vegetation is cut, permitted to dry and then burned. The goal is to remove as much of the debris as possible before planting the crop. The steps taken in the clearing process are as follows:

First: The low underbrush and shrubs are cut with a machete, (a long knife) and left to dry for several days. Next, the larger trees are felled with an axe. Then all of the vegetation is allowed to dry for two or three weeks and is then set on fire. The seemingly long time span greatly facilitates the drying process and insures a more complete burn.

For burning, a warm day with a light wind is selected. The vegetation is set on fire on the windward side of the clearing so that the fire will

spread across the land with the aid of the wind. The success of this burn depends on the skill of the colonist in the use of the fire. This means he must be able to determine when the vegetation is sufficiently dry to burn and when the wind is sufficient to carry the fire across the clearing, but not too much to cause an overburn that will leave much of the branches and logs unburned. When this happens, the farmer is left with a tangled mass of unburned branches, logs and brush that will hamper his planting, cultivating and harvesting operations. Also, if much of the vegetation is left unburned, the ashes, which act as a fertilizer for the first crop, will be much less. If the colonist waits too long to make this burn, regrowth may start or the rains may come, resulting in poor burns.

Often the larger trees are left during the clearing process. Large trees can take up to three or four days to fell and because of the time factor they may be girdled so that they will die and not shade the crops. Some of the colonists gather the charred, unburned vegetation, pile it and burn it following the first burn. This latter operation is done when tree crops are planned.

The amount of land cleared is limited to the amount of labor available to the colonists. It is estimated that one experienced land clearer can clear a hectare of virgin land in 45 days. As the period for land clearing is 3 months, the most one man can clear in a season is two hectares. Additional land clearing can be done if the colonist has children old enough to work, or if he has money to hire someone to help him. Available labor is limited during this period due to requirements in harvesting other crops.

Experience is a key factor in land clearing. When the colonist has no experience in land clearing, he may not be able to clear more than 1/2 hectare, and many times he ends up with a poor burn. That is one of the reasons that spontaneous colonization is considered better than directed colonization because the spontaneous colonizer has usually either worked for a colonist or his family or has friends in the area to help him with his first land clearing.

Usually at the same time of his land clearing, the colonist begins the construction of his house. Some of the poles and other materials used in building his house are taken from the trees he has felled in the land clearing.

- Crop Production

The colonist begins to plant his crop as soon as the vegetation has been cleared and burned. If he waits until the rainy season gets under way, the soil may be too wet or the seed germination may be affected. However, the beginning of the rainy season is the prefered time to plant because the weather is more pleasant and labor requirements for weeding and harvesting becomes more pressing later in the season.

Rice is usually the first crop planted in the new clearing. It may or may not be associated with corn. One man can plant a hectare of rice in 6 days.

Yuca is nearly always planted at the end of the first year. It is planted for food for the family although there is presently some yuca being sold outside of Chapare. Yuca replaces potatoes in the diet, is ready for harvest in 10 months or less and may be left in the ground and harvested as needed for 2 years.

After the corn-rice phase a farmer traditionally moves into a less intensive nutrient-requiring and less labor intensive crop such as yuca, banana, and citrus. Coca normally is introduced into the system the second or third year after land clearing, i.e., after rice corn and perhaps yuca or other short term crops. Coca is usually planted in association with bananas.

Crops associated with other crops, interculture, is a common practice in the Chapare. The principal reason for this is to produce as much as possible from a limited piece of land. Interculture reduces weeding time by keeping as much of the land shaded as possible. It also reduces erosion. Corn, coca, and citrus are intercultured with bananas and/or corn or yuca.

The interculture of crops is also related to soil fertility. Rice is the first crop planted because it requires fertile soil. Corn also responds to fertility and may be planted inside the rice plantings. Yuca, bananas and other crops that feed at a lower level in the soil are planted the second year and may be associated with tree crops until these crops come into production.

Consequences of Current Production System

High rainfall brings about rapid leaching of soil nutrients, depletion of organic matter and increased soil acidity which causes the soluable phosphates in the soil to react with iron and aluminum to form insoluable phosphates. Chapare farmers have reacted to these problems in two ways: a) By planting permanent crops such as coca, bananas or citrus that have deeper root systems and shade the ground and b) by abandoning to brush the fields planted to annual crops such as rice and corn after two or three years.

Land abandoned to brush or second growth forest tends to recover a considerable measure of its original fertility after a cycle of from eigth to twelve years. Farmers with limited land areas or farmers utilizing more than two or three hectares in annual crops soon cut through their virgin forest and are forced to reuse brush lands before they have had time to recover their fertility. This accellerated reuse of second growth forest and low shrub savanna is rapidly lowering the productive potential of the area. As larger percentages of small and medium farms are devoted to permanent crops the remaining hecterage has to be utilized all too frequently, under the traditional system, for annual crops. Production per hectare is declining and many farmers are ceasing to produce annual crops beyond subsistance needs. Furthermore, the system of reclearing a hectare of land is very costly in terms of labor requirements.

Proposed New System

The pace of slash-and-burn system can be slowed down considerably by the immediate introduction of practices designed to permit permanent cropping with hand labor and traditional tools. Such practices are designed to greatly reduce weed intrusion and regrowth of brush. They are proving to be effective in many areas of the world having similar agronomic conditions.

Essential guidelines to these cultural practices include: a) continued use of intercropping and multiple cropping to keep the ground shaded as much of the time as possible; b) rotation of crops with leguminous forage/pasture plants as a means of optimizing production, capitalizing on investment in land clearing, conservation and improvement of soil fertility, and management of weeds; c) increasing plant densities; d) continued use of minimum tillage or no-tillage techniques; e) ridging of poorly drained or high rainfall area soils.

These ridges can be a meter apart and built up with a hoe or shovel in the absence of animal power to a height of 25 cm. at the center and 30-40 cm. wide at the base. They should be built the second year after clearing in order to avoid heavy root growth that will have decayed. The ridges should be serviceable for several years with only slight rebuilding for annual crops grown under multiple cropping or no-tillage systems.

The basic system envisages a 5 year rotation as follows:

Years One and Two: The land is prepared by slash and burn or by thoroughly recleaning brush land. Ridges are not required although previously ridged land may be use. Various combination of rice, corn, beans, peanuts, and vegetables can be intercropped. A few illustrative examples follow:

a) Rice/Corn/Soybeans

Plant rice in rows approximately 30 cm. apart and 25 cm. between plants, using 40 Kg. of improved seed per hectare. At the same time the rice is seeded, interplant every fourth rice row with corn at the rate of one hill of corn per meter. This will give 16,000 corn plants per hectare which will help cover the ground while causing little or no reduction in rice yield.

When the rice grains reach the early dough stage of maturity, interplant with soybeans in single rows. Space plants 12.5 cm. apart in the rice and corn rows. Since the soybean plants will be small at the time of rice harvest, they will receive a minimum of damage in the harvesting operation. Up to the time of germination of the soybeans, weeds may be controlled with herbicides or hand tools. After the soybeans germinate, only hand tools may be used. If the following year's rotation includes corn as the principal crop, ridges should be built, as indicated above, before seeding.

b) Corn/Black Beans

Ridges, approximately 1 meter apart, 25 cm. high at the center and 30-40 cm. wide at the base are made with a hoe or shovel. Improved flint corn seed is planted at 25 cm. intervals in the center of the ridge and thinned to one plant per hill. This gives a plant population of 40,000 per hectare, which under favorable rainfall conditions will rapidly shade the ground, thus suppressing weed population and weed growth. Weeds that appear must be eliminated before they are over 4 cm. high. This may be done by hand tools or by carefully directed herbicide.

When the corn is flowering, beans (cow peas may be substituted) are planted on the ridges between the stalks of corn. The bean or pea population will also be 40,000 hills per hectare. Continue weed elimination as required using only hand tools.

After harvesting, crop residue is chopped up with a machete and left as a mulch on the land. Under Chapare climatic conditions the next annual rotation may be started immediately after harvesting the corn and Beans.

c) Corn/Rice/Peanuts

Plant corn on ridged rows one meter apart, as in previous combination. Use a plant population of 40,000 per hectare. Plants will be 25 cm. apart placed on top of the ridges. Control weeds as indicated in previous section.

When the corn is in flower, plant two rows of rice 30 cm. apart with 35 cm. between plants in the corn middles thus leaving each side of the ridge vacant for later planting of peanuts. Use 18-20 Kg. of improved seed per hectare. Control weeds as required using hand tools or herbicides. When the rice grains reach the early dough stage of maturity, interplant with peanuts. The peanuts are planted on each side of the ridge in order to provide a soft, well drained area for the penetration of the flower spikes as well as allowing for complete ground coverage after rice and corn are harvested. The peanuts will be 25 cm. apart in the rows. Keep weeds under control with hand tools. If the ridges erode or broaden excessively due to heavy rains, build them up again, after rice is harvested, with a shovel or hoe.

d) Vegetable/Corn

Plant corn on ridged rows as indicated above, except that the spacing between plants in the row will be 50 cm. giving a plant population of 20,000 per hectare. After the corn has emerged, the vegetables may be planted. The vegetables seed may be intermingled or planted in blocks of pure stands. All seed or seedings are planted on the ridges between corn plants.

When corn is two weeks old, plant:

Species	Spacing
Pumpkin	6 m x 6 m
Watermelon	3 m x 3 m
Tomatoes	1 m
Pepper	50 cm.
Onion	12 cm.
Cow peas	12 cm.
Green beans	12 cm.
Cucumber	2 m
Egg plant	50 cm.
Sweet potatoes	25 cm.

This combination considers vegetables to be the principal crop. The corn, which will not materially reduce vegetable yields, is included to provide ground cover to suppress weeds. It is unlikely that a farmer would plant more than 1/6 to 1/3 of a hectare under this system. It is intended for home food production with a slight surplus of some commodities for sale.

Year Three: In this year kudzu or other leguminous ground cover is introduced into the system as follows:

Plant corn on ridge land. Unridged land may also be utilized for this system where the farmer has a severe labor constraint or is just begining to participate in multiple cropping technology. Corn will be planted at 25 cm. intervals in one meter rows, which gives a plant population of 40,000 per hectare. As the corn is germinating, kudzu is interplanted between the

the corn plants on the same ridge. Two or three seeds are planted 2 cm. deep between every third and fourth corn plant or about 75 cm. apart. This will require approximately two Kg. of kudzu seed per hectare. Alternatively, kudzu root crowns from other local stands may be interplanted at one meter intervals in the rows of corn. Care must be taken not to allow the root crowns to dry out from the time they are dug until they are transplanted. The kudzu plant has up to 23% protein in the leaf on a dry matter basis. Cattle and swine thrive on it as their only forage. Grazing may be initiated as soon as the kudzu has completely covered the ground (after corn has been harvested).

Other vigorous legumes such as stylosanthes, centrocema or lab-lab may be susbtited for kudzu under differing local conditions. Legumes that are well adapted to the area and are palatable to livestock should be used.

Year Four: The legume ground cover should be retained for at least two years as a weed and brush suppresant as well as a soil builder. (Years three and four). Weeds or brush that emerge above the kudzu cover should be cut back to ground or stump level at least twice a year.

Year Five: Starting in year five, the farmer has various alternatives, as follows:

a) He can keep the land in pasture or use it for haying for a number of years.

b) He can introduce tree crops, leaving the leguminous cover in place to control weed growth and add nitrogen to the soil until such time as it is shaded out by the trees. In the case of kudzu, care must be taken to keep the vines out of the trees. A one-half meter clean circle should be maintained around the base of each tree to reduce losses from fungus and bacterial diseases.

c) He can reinitiate a new cycle of annual intercropping. For this purpose, he may decide to use herbicides to destroy the kudzu sufficiently to permit returning the land to the production of annual crops. Kudzu adds approximately 80 Kg. of nitrogen per hectare per year. If the huge mass of leaves and stems are left on the land as a mulch after the application of herbicides, other plant nutrients including phosphates, potash and micro-nutrients will be released for crop growth as the organic material decomposes. Alternatively, he may decide to clean the area by removing stumps mechanically. Such a cleaning operation will also destroy the kudzu sufficiently to permit returning to annual crops. The stump removal itself will be easier and more economical after the land has been covered with kudzu for at least two years.

The methods for promoting and financing adoption of the new crop rotation system described above, the targets for adoption rates in terms of hectares and numbers of participators is described in Chapter V C.

it is not necessary for a new participant to begin with year one of the process. A given farmer may start with a third or fourth year component on that portion of his farm which has been in annual crops for two years, while simultaneously getting credit and technical assistance to initiate a first year component on newly cleaned land.

3. Current Production of Crops

Rice and corn account for the bulk of the land devoted to annual crops. They have frequently been grown in association (interplanted), a practice which will become more common with the adoption of the multiple cropping technology recommended in this project. The basic problems and indicated solutions are also similar for the two crops. The areas of high rainfall makes the production of grain sorghum (a third basic grain) a high risk crop. It is possible that open panicle varieties could find limited use in feeding dooryard poultry.

- Rice

Rice occupies more land in the Chapare than any other crop: 14,747 hectares. It is the first crop planted after the slash-and-burn operation, and is sometimes planted twice before the land is put into other crops. It has been estimated that up to 25% of the income for new settlers in their first few years is from rice. NACA's Boletin Estadistico reports that in 1977 the rice production of the Chapare was utilized as follows: 2% for seed, 20% for home consumption and 78% was marketed. It is further

reported that over 20% of the harvest is lost to insects, rats and molds. Although the Chapare produces approximately 10% of Bolivia's annual rice crop, production per unit area is low. The 1977 average production for the area was 1,285 Kg/Ha. while the national average was 1,450 Kg/Ha. This difference is probably due to low yielding varieties, low seeding rates and lack of adequate weed control. All plantings in the area are upland rice which normally yields considerably less per unit area than paddy rice. The variety most commonly planted is "Blue Bonnet". This is a good quality rice; however, there are several varieties which should give higher yields, e.g. Cica-6, Bluebell and Bluebonnet Sel.

Use of improved technology could make rice a much more productive crop in the area. Improved technology should include the use of better seed varieties, weed control, insect and disease control, improved harvesting methods, better drying techniques and adequate, well ventilated storage.

Colonists in the Chapare are under a labor constraint that limits their capacity to farming of from 2 to 3 hectares in annual crops.1/ Rice growing under traditional technology appears to be demanding an excessive number of man days of labor for harvesting and threshing.

1/ The typical Chapare farmer apparently does not attempt to farm more land than he can easily take care of with available labor, taking into account the size of his family. The labor availability analyses in Section III B-6 of this report shows a labor surplus in each month of the year.

As the yield per hectare increases, days required for harvesting and thrashing may well exceed forty. Farmers must be taught to cut and bundle the rice and place the bundles in shocks for drying as is done in other countries having similar climates. The cutting may be done with a sythe or machette. It may be desirable to introduce stationary thrashers to do custom thrashing. ever, hand thrashing on a simple pole-constructed table is also effective. Since rice is usually harvested with a moisture content of from 18 to 24%, it must be further dried before storage to about 14% moisture. The construction of drying patios and grain storage bins at the farm level will greatly reduce post harvest losses. Storage facilities will also enable the farmer to delay marketing so as to receive a better price for his product after the usual harvest season slump.

- Corn

Corn production in the Chapare has been principally for domestic consumption. The varieties used appear to be the same criolla varieties grown in the Cochabamba area. Cuban yellow Tuxpino or Synthetic Q should do well there. Corn is usually planted in association with other crops. The low plant population used in the area contributes to the low yields. There is little or no evidence that colonists have received any guidance in planting better varieties, utilizing correct spacing, controlling weeds or combatting insects and diseases. With proper guidance to farmers to adopt improved

technologies, corn could become an economically important crop for the area. It could be marketed after proper drying and storage to avoid the harvest season slump or it could be marketed through swine.

- Grain Storage

Sale of high moisture content grain can result in low farm prices. Sale during the glut of harvest time can also result in low farm prices. The colonist may find himself in need of cash or with the desire to sell only small quantities of grain. The colonists need a system which will relieve as many of these marketing disadvantages as possible. One action is to construct and utilize on farm storage utilizing a dry, well ventilated storage structure. The structure should be completely encased with 1/4" mesh wire for rodent protection. Such a storehouse would be first priority along with a 10' x 20' drying and threshing floor for each farmer adopting the multiple cropping and legume cover system discussed above. The provision of such protected storage, in addition to its beneficial effect on market timing, will also result in reduced post harvest losses which in recent worldwide studies were shown to range from 25% to over 35% of the total crop harvested.

- Peanuts

Peanuts are grown during the dry season. The variety used produces a good quality nut; however, the yields are only fair. Low yields may be attributed to the plant spikes inability to penetrate the soil and set nuts.

Putting soil to the plant immediately before the plant puts out spikes would increase the yield substantially. Peanuts are generally consumed by the family and are not grown as a commercial crop.

- Papaya

Papaya is well adapted to Chare. Yields are good and quality of fruit is excellent. At present prices and average yields, it is the highest income producer per hectare of the tree crops in the Chapare. Papaya is generally planted in association with other crops. Due to transport problems between the farm and improved roads and the perishibility of the fruit, farmers have been reluctant to plant large tracts in papaya. Percentage of land planted to papaya is small and limited to areas with easy access to all weather roads. With road improvement in the interior of Chapare, papaya production would be expected to increase.

- Citrus

Citrus is second to bananas and plátanos in the area covered by tree crops (about 15% of the total cultivated area according to MACA data). It is estimated that only 50% of the plantings are currently in production. Oranges and other citrus are generally planted by seed directly in the grove; therefore, the variety is criolla of various fruit types. As a result, the quality of fruit is poor. They differ in chemistry, color, size, and shape, making industrialization and grafting difficult. Additionally, the Criolla varieties are very suceptable to a root disease "phytophthora". Farmers

have also planted citrus in areas where poor drainage agravates "Phytophthora". As a result of this disease and poor site selections, the average life of citrus in Chapare is slightly more than 15 years, with substantial numbers (perhaps as much as 40%) becoming non-productive after 10 years from planting. As Criolla varieties take from 6 to 8 years to start producing, the production life of citrus in Chapare is about 2 to 10 years.
Average production life of citrus under normal conditions is over 30 years. Besides the short productive life of citrus trees and poor quality of fruits in Chapare, the bearing span per year is short. Production can be greatly improved by limiting citrus plantings to appropriate areas (zoning) and by importing "Phitophthora" resistant root stock and grafting this with good quality fruit and wood. This effort has been started on a modest scale at the local research station. It needs to be greatly expanded. However, if the result is significantly expanded production levels, there may be marketing problems.

- Bananas/Plátanos

Bananas/plátanos are well adapted to Chapare ecological conditions. Bananas occupy more land than any other perennial crop in the area except coca. The yields of bananas are average when compared to other countries producing bananas. The quality of bananas being produced satisfies the local demand. However, other varieties that would be more acceptable for export have been tested in Chapare and have been proven to be adapted. Yields

could be substantially increased by using improved cultural practices. Bananas are usually planted the second year after land clearing and are generally interplanted with other crops e.g. citrus, yuca, and cocoa.

There is limited export of the current varieties to Northern Argentina. A feasibility study of the possibility of marketing chilled banana to the Argentine population centers is indicated.

- Pineapple

Pineapple is presently being grown in the Centrales of Maripoza, Colonia Maiga and Central Busch. These areas are sandy which makes them well adapted to pineapple production. Criolla varieties are planted by small farmers. These varieties yield poorly, the fruits are small and ill shaped and are subject to a number of insects and disease problems. There is a commercial farmer in Maripozas who is producing an imported variety "Cayena Lisa" that appears to be well adapted to the area. With the new variety, plus use of recognized cultural practices along with fertilizer, fungicides and insecticides, the commercial farmer has been able to increase the yield by 500% over that of the small farmers. Improved shoots for establishing nurseries to be operated for the benefit of small farmers should be imported. The market potential is good.

- Yuca

Yuca is well adapted to Chapare conditions. It is grown in all parts of the Chapare with excellent yields. Yuca is generally consumed by the family. Small areas of 1/10 of a hectare are sufficient to provide the requirements for the family. There are possibilities of dehydrating and marketing yuca as animal feed. Also, some multiplication of new, high protein varieties is indicated.

- Avocado

Avocados are being grown extensively in the Espiritu Santo and Paractito micro-regions. These areas are commonly known as the higher altitudes of Chapare. Avocados are not adapted to other zones. In the two areas mentioned above, the yields are variable from year to year. However, some years the crop is an important input to the farm income. Some adaptation trials with improved varieties is indicated.

- Forage

Kudzu is already growing well in the Chapare. There is ample visual evidence that this legume does control brush, weeds and grass infestation. A few hectares of kudzu are being harvested for hay and sold to the dairy industry in Cochabamba.

The two agricultural experiment stations, La Jota and Chipiriri, have test plots and field trial experience with a considerable number of legume species. Several of these can now be recommended to farmers. Stylosanthes, although not a viny legume, has shown promise in trials at Chipiriri and La Jota, both as a forage and when interplanted with corn. Stylo. can be substituted for kudzu in orchards and where brush is not a problem. Centrocema is a low growing viny legume that does well in the area and is somewhat shade tolerant. It is recommended for planting under permanent tree crops.

4. Livestock and Poultry

There has been no sifnificant commercialization of any type of animal or poultry production by colonists in the Chapare. With the exception of fish from the Chapare, for which there is substantial demand in the local, Cochabamba and other markets, the limited production of animal products is utilized primarily for home consumption and sale to local markets.

To date, cattle have played only a minor role in the development of the Chapare. Very few colonists have cattle, and oxen are extremely rare.

- Beef Cattle

The colonists do not engage in beef production.

The only beef operation in the Chapare is Empresa Ganadera "Aurora" located in Ivirgarzama. This enterprise was established 6 years ago with the intention of fattening cattle from the Alto Beni. The traditional route of live Beni cattle destined for the Cochabamba market has been by river to Todos Santos or Puerto Villarroal and then by truck through the Chapare. The empresa has a 780 Ha. concession, of which 180 Ha. have been cleared.

According to the owners, the fattening concept was unsuccessful because of the lack of qualified labor, high cost of land clearing and pasture establishement, lack of interest in, and help from, governmental institutions, and the inability of Beni cattle to adapt to fences. Currently, the property is being operated as a breeding property with the offtake being sold to the Cochabamba market. A Holstein Bull was acquired for crossing with Criolla cows. A calving rate approaching 60 has been achieved and reportedly the hard now numbers 250. 2/

- Dairy Cattle

PRODES in a 1978 survey 3/, found that 20% of the colonists had milk cows and that the numbers are growing. Ownership appears to be something of a status symbol. The cows are Criolla, are staked out to feed and produce

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2/ Medina Rubio, Edilberto: "Estudio de Mercadeo del Area del Chimoré". IICA - PRODES (1979).

3/ PRODES: Estadísticas 1978.

8-9 liters of milk a day. Production is for farm consumption.

Some efforts are being made to improve the quality of the Criolla cows. The Chipiriri Research Station has brought in Brown Swiss and Holstein bulls for crossing with Criolla cows. A Methodist church group is also working with approximately 100 farmers in a dairy improvement project. Brown Swiss bulls have been brought in and technical assistance in cheese making provided.

- Cattle Prospects

Successful implementation of the proposed new cropping system will bring about large scale plantings of kudzu, stylosanthes, and other legumes that are excellent forages for cattle. Carrying capactities will be as high as two animal units per hectare. There is likely to be an increasing tendency on the part of area farmers to include cattle in their farm plans. If carefully guided by project officials, cattle and/or water buffalo can, over the long term, become economically important in the intensive farm production systems. To support and encourage this tendency, it is proposed to convert the Chipiriri Experiment Station into an animal production center.

The integration of cattle into the diversified farm plan is purposely paced over a long time span.

The plan has been developed to allow the farmers to capitalize their farms over time as they gain experience. A colonist who adopts the new farming system has a minimum of one hectare of legume forage by the end of the third year. This hectare of forage plus his normal crop residue is capable of carrying about two animal units and from 4 to 6 hogs. Many of the older and larger farms already have considerable land in brush. These lands could be recleaned and brought under legume cover at a reasonable cost.

The approach recommended is to guide the area away from cattle fattening and into the breeding of draft animals and milk production. Two kinds of animals are recommended. They are water buffalo and native cattle crossed with Brown Swiss bulls.

The Colonization Institute (INC) imported the Mediterranean and Murrah breeds of water buffalo from Brazil several years ago. The herd has proven to be extremely well adapted to conditions in the Chapare and have been giving over a 70% calf crop per year. They seem to be resistant to anaplasmosis and piroplasmosis, two tick borne diseases prevalent in the area and to which exotic cattle breeds are highly susceptable. The water buffalo is good for beef and is a good producer of milk even under adverse conditions. Bulls weigh about 1,000 pounds at five years of age while the cows reach a weight of about 600 pounds in the same time period.

It is proposed that the water buffalo herd management, training, and distribution responsibility be transferred from INC to the project management.

The herd could then be transferred to the Chipiriri Animal Center for continued multiplication, training of oxen and placement of cows and oxen with selected farmers. It may prove desirable to import additional breeding stock.

A system of distribution patterned after the one that has worked so well for Heifer Project International in Bolivia should be tried. Under this system a training program would be set up at the Chipiriri Experiment Station. Assistance in organization and management of the animal and farmer training program could be arranged with the Menonite animal training center in Santa Cruz. The buffalo herd should be carefully culled so as to have the best bulls for reproduction. The culled bulls would be castrated and trained. Distribution might be handled through sindicatos. The first ones chosen should be in poor access areas where a single buffalo drawn cart could be most useful in moving product from the farm to all weather roads. Through any given sindicato receiving work animals, one bull and up to six cows should be distributed to individual farmers. The price per animal would be the return to the Chipiriri Experiment Station of the first calves at age 12 to 18 Mos. for continuing the program with other farmers. Animals would also be sold to farmers by the Chipiriri Center.

There also seems to be means whereby the colonists could acquire cattle, over time, without high cash outlays. A considerable number of cattle

from the Beni are marketed in Cochabamba. They are shipped over the Beni-Chapare river route to Puerto Villarroel and then to Cochabamba by truck. The practice of Beni cattlemen furnishing cattle to colonists on a share of the offspring basis is already well established in some of the older colonies along the Santa Cruz outlet from the Beni. The colonist keeps the parent animals through two calf crops and then takes half the increase. By crossing the Beni cattle with Brown Swiss bulls the colonist is moving toward reasonably high milk producing cows. The castrated bull calves will reach sufficient size to make good oxen. The Brown Swiss crossed with Criolla cattle has proven hardier and more disease resistant than most other exotic breeds under conditions such as those found in the Chapare.

In order to help guide the development of the cattle and buffalo enterprises in the project area, it will be necessary to have a strong animal health unit working out of the Chipiriri Center. This same unit should also take care of swine disease prevention requirements.

- Swine

Some 40% of the colonists have pigs, according to the PRODES Study 4/. They are criolla, are not penned, and scavenge for their food. Production is for farm consumption with perhaps some limited local marketing.

4/ PRODES: Estadistica 1978.

There is one commercial swine operation, owned by Cochabamba interests, near Villa Tunari, which was established 3-4 years ago. Its capacity is 2,000 head and it currently has an estimated 1,000 head breeding stock-Duroc, Hampshire and some Yorkshire were brought in from Argentina. All feed concentrates are brought in from Cochabamba. Only casual quantities of local feed, e.g. over-ripe bananas, are fed although the owner is in the process of establishing kudzu pastures. Production is sold live in Cochabamba markets at 100 Kg. live weight. The owner reports that the project is profitable.

The Chipiriri Research Station has recently acquired Hampshire, Duroc and Poland China breeding stock with the intention of improving the quality of the local criolla swine.

Swine production is a key element in the diversified farming pattern being proposed under the new crop rotation system. In the project area, shortage of capital is a constraint and lack of management "know how" is a constraint. On the other hand, many crops in the multiple cropping pattern have surplus production or production that is below market quality and can best be marketed through hogs. These crops include fruit and vegetable as well as gleanings after the harvest of corn, rice or peanuts. Certain crops may be planted in excess of labor availability or marketing intentions specifically for "hogging off". The legumes planted in the third year of

the rotation system provide excellent high protein forage for grazing swine. By harvesting these commodities with hogs the farmer economizes on labor as well as on capital expenditures. About all he has to buy is mineral supplement, lateral fencing and possibly, electric cross fencing. His fencing and electric cross fencing allow him to move the pigs freely about the farm in order that they may do their own harvesting. This low cost production system can be highly competitive with the more complex system in common practice.

- Poultry

Eighty percent of the colonists have chickens, with flocks being from 5-15 birds [5/]. They are of indiscriminate lineage, run loose and scavenge for their food. Some ducks and turkeys are also seen. Meat and eggs are primarily for farm consumption although there is some trading in the local and Cochabamba markets.

There is no significant commercialization nor are there any poultry research programs.

5/ Figueras, J. Antonio: "El Chapare: Sus Recursos y Sus Usos", Misión Universidad de Florida en Bolivia. 1976-1978

· Fish

From personal observation, there is a continuing demand for fish from the rivers of the Chapare but the supply is erratic. No information is readily available on market demand and potential.

Commercialization is pursued in the following manner: several Cochabamba wholesalers drive trucks filled with ice (no ice is available in the Chapare) once or twice a week to established river side locations in the Chapare. The trucks wait until local fishermen catch enough fish to make a load. The fish are then marketed in Cochabamba and elsewhere.

5. Use of the Land

As indicated earlier, there are two typical farm sizes in the Chapare: the spontaneous colonization farm unit which is 10 hectares and the directed colonization farm unit which is 20 hectares. The following table shows how the land is used by a typical farm unit under each of these models.

As will be noted, the major difference is in the non-cultivated area (5.46 hectares for the smaller units and 16.23 hectares for the larger units). As regards the cultivated area, the directed colonization units have a slightly larger area in annual crops and the spontaneous colonization areas have somewhat more area in perennials. This is probably a function of the longer life of the majority of the . ntaneous coloni-

zation forms.

The 10 hectare typical farm shown is of full development under the present farming system. Consequently, its fertility is being depleted faster than on the larger farm, although both are using a slash and burn technology. Offsetting this, in terms of income, is the higher returns from the perennials which occupy a larger acreage on the smaller farms.

Table III B-1

Average Area Per Farm in

Crops, Fallow and Uncultivated Land

PRODUCTS	Spontaneous Colonization		Directed and Semi-Directed Colonization	
	Area (Has)	%	Area (Has)	%
Rice	1.16	12	1.73	9
Coca	0.82	8	0.32	2
Bananas	0.77	8	0.43	7
Citrus	0.68	7	0.28	1
Other*	1.13	11	1.01	5
Sub-Totals	4,56	46	3.77	19
Area not Cultivated				
Brush Fallow and Virgin Forest	2.32	23	2.89	14
Uncultivated Land	3.14	31	13.34	67
Sub-totals	5.46	54	16.23	81
Totals	10.02	100	20.00	100

* Yuca, corn, papaya, peanuts, tomato, taro, etc.

As will be seen in other sections of this report, it is proposed to introduce into the region a diversified crop rotation system, involving continuous use of 2 hectares of legumes in ground cover and/or forage; it is also proposed to introduce on a commercial scale substantial plantings of rubber, tea, cacao, pineapple and pejivalle. The legumes will be promoted on an across-the-board basis, region wide. The specialty crops will only be promoted in selected zones and, in such fashion that -- in general -- only one specialty crop will be promoted in any given zone.

Conditions as to actual land use vary from zone to zone. We have attempted to disaggregate the data in Table III B-1 so as to show the actual cropping pattern for the zones selected as potential areas for promotion of each of the new specialty crops. This data is presented in Table III B-2. As can be seen there are wide variations both as regards total area cropped and especially as regards crop mix.

Table III B-3 projects what the total cultivated area would be, zone by specialty zone, if the new legume plantings and the new specialty crops were simply added to the existing cropping pattern. As can be seen, while there are wide variations, all systems still fall within the limits of a 10 hectare farm. It is unlikely, however, that most farmers would follow a simple, "add-on" proceedure. Instead, if they adopt the new system and new cash crops, they will probably cut back on some of their current plantings. The most likely candidates for such cut backs are rice and "Other Crops", e.g. yuca and corn. Table III B-4 shows what the hypothetical results would be of a 100% substitution of the new crops for rice

and "other crops".

The most likely prognosis is that neither extreme will be followed. Instead, we are likely to find cultivated area ranging as follows:

a) In the rubber zones, from 5.32 has. to 8.84 has.

b) In the tea zones, from 3.75 has. to 6.83 has.

c) In the cacao zones, from 5.10 has. to 9.40 has.

d) In the pineapple zones, from 2.40 has. to 5.62 has.

e) In the pejibalie zones, from 3.82 has. to 7.30 has.

While zones for specialty crops were selected on an agronomic suitability, rather than a current land use basis, it will be noted that there is a close fit between low total cultivated acreage and high labor intensivity new crops, i.e. tea and pineapple.

Table III B-2

Average Cropped Area Per Farm

According to Area of New Crop Emphasis

(In hectares)

Area Presently Planted to Various Crops

New Crop Emphasis	Total	Rice	Coca	Banana	Citrus	Other
Rubber	4.84	1.38	0.77	0.89	0.66	1.14
Tea	4.33	1.10	1.04	0.46	0.75	0.98
Cacao	4.90	2.20	0.41	0.78	0.38	1.13
Pineapple	3.12	1.18	0.50	0.21	0.20	1.03
Pejibaye	4.30	1.40	0.61	0.66	0.58	1.08

Table III B-9

Maximum Area Cultivated Under New System

And New Crops

(In hectares)

	Rubber Area	Tea Area	Cacao Area	Pineapple Area	Palibaya Area
Total Previously Planted	4.84	4.33	4.90	3.12	4.30
Area Planned for New Crops	2.00	0.50	2.50	0.50	1.00
Sub-total	6.84	4.83	7.40	3.62	5.30
Area In Ground Cover and/or Forage	2.00	2.00	2.00	2.00	2.00
Total	8.84	6.83	9.40	5.62	7.30

Table III B-4

Area Cultivated, Including New Systems and New Crops, on a Substitution Basis

(In hectares)

	Rubber Area	Tea Area	Cacao Area	Pineapple Area	Pejibaye Area
Total Presently Cropped	4.84	4.33	4.90	3.12	4.30
Minus Area in Rice and "Other Crops"	2.52	2.25	1.60	0.90	1.82
Plus Area Planned for New Crop	2.00	0.50	2.50	0.50	1.00
Plus 1 Ha. in Cover Crop or Forage	1.00	1.00	1.00	1.00	1.00
New Total	5.32	3.75	5.10	2.40	3.82

6. Labor Utilization and Requirements on the Typical Chapare Farm

It is often stated that labor is a major constraint to any development of the small farm in the Chapare. It is also reported (there are no actual figures) that as many as 10,000 seasonal wage laborers come from the Cochabamba area to the Chapare for work in land clearing and harvesting.

Assuming that a typical farm would have a full time labor force of 2 1/2 persons, or 50 man days per month (2 1/2 persons x 20 work days), we attempted to determine whether or not availability of labor would be a constraint for the type of new cropping systems and new crops which it is proposed to introduce into the region.

We first developed a per hectare profile indicating the labor required per hectare for the major commercial crops now being produced in the Chapare and used a soybean labor coefficient for the remaining area shown as "other crops" in the preceeding section. This data is presented in Table III B-5.

Table III B-6 takes the typical farm described earlier and applying the per hectare coefficients to the actual hectarage per farm 6/ shows the labor requirements for that farm in terms of person days per month. When this is compared to the assumed labor availability (50 man days per month) we can determine the suplus or deficit person days per month. This is not to say that the typical farm may not carry over work from one month to another, trade labor with neighbors, or hire labor from outside the farm or area.

The exercise shows that there is a surplus in all months of the year, with March being the most critical month; that there is an annual surplus of 228.7 man days of labor per farm and that a 2 1/2 person work force is utilized at a 62% level of efficiency.

6/ For this calculation we are using the total number of hectares on both spontaneous and directed colonization farm units, divided by the total number of production units as shown in Annex No. 2.

Table III B-5

Per Hectare Labor Requirements For Major Crops in Person-Days

Crop & Activity	July	Aug.	Sept.	Oct.	Nov.	Dec.
Rice						
Land Clearing	14.00	14.00	4.00			
Planting				2.00	2.00	1.00
Weeding				2.70	4.30	2.70
Harvesting						
Totals	14.0	14.0	4.0	4.7	6.3	5.3
Yuca						
Clean Land						
Planting						
Weeding	5.00	2.50				
Harvesting 1/	10.00					
Totals	15.0	2.5				
Bananas						
Planting		1.50	1.50			
Weeding		5.00	5.00			5.00
Harvesting	4.00	4.00	4.00	4.00	4.00	4.00
Totals	4.0	10.5	10.5	4.0	4.0	9.0
Coca						
Planting	47.50	47.50				
Weeding	7.50		7.50	7.50	7.50	7.50
Harvesting		17.50	17.50		17.50	17.50
Totals	55.0	65.0	25.0	7.5	17.5	25.0
Citrus						
Weeding				3.30	3.40	3.30
Harvesting	10.00					
Totals	10.00			3.3	3.4	3.3
Papaya						
Weeding				5.00	5.00	5.00
Harvest	8.00	8.00	8.00	8.00	8.00	8.00
Totals	8.0	8.0	8.0	13.0	13.0	13.0
Soybeans						
Planting				2.7	2.7	2.7
Weeding					5.33	5.34
Harvest						
Totals				2.7	8.0	8.0

1/ The Yuca harvest is one year or more after planting.

Table III B-5 (Continued)

Per Hectare Labor Requirements For Major Crops

In Person-Days

Crop & Activity	Jan.	Feb.	Mar.	April	May	June	Totals
Rice							
Land Clearing						14.00	46.0
Planting							5.0
Weeding	2.70						14.0
Harvesting		8.00	9.00	8.00			25.0
Totals	2.7	8.0	9.0	8.0		14.0	90.0
Yuca							
Clean Land			5.00	5.00			10.0
Planting				1.00	1.00	1.00	[illegible]
Weeding					2.50	5.00	15.0
Harvesting 1/					10.00	10.00	30.0
Totals			5.0	6.0	13.5	16.0	58.0
Bananas							
Planting							3.0
Weeding	5.00		5.00	5.00			30.0
Harvesting	4.00	4.00	4.00	4.00	4.00	4.00	48.0
Totals	9.00	4.0	9.0	9.0	4.0	4.0	81.0
Coca							
Planting							95.0
Weeding	7.50		7.50	7.50		7.50	60.0
Harvesting		17.50	17.50		17.50	17.50	140.0
Totals	7.5	17.5	25.0	7.5	17.5	25.0	295.0
Citrus							
Weeding		3.30	3.40	3.30			20.0
Harvesting				10.00	10.00	10.00	40.0
Totals		3.3	3.4	13.3	10.0	10.0	60.0
Papaya							
Weeding	5.00	5.00	5.00				30.0
Harvest	8.00	8.00	8.00	8.00	8.00	8.00	96.0
Totals	13.0	13.0	13.0	8.0	8.0	8.0	126.0
Soybeans							
Planting							8.1
Weeding	5.3						15.9
Harvest	10'00	10.00	10.00				30.0
Totals	15.3	10.0	10.0				54.0

1/ The Yuca harvest is one year or more after planting.

Table III B-6

Farm Labor Profile On Typical Farm For Chapare*

Crop & Activity	Area	July	Aug.	Sept.	Oct.	Nov.	Dec.
Rice							
Land Cleaning	1.00	14.00	14.00	4.00			
Planting	1.33				2.66	2.66	1.33
Weeding	1.33				3.59	5.72	5.72
Harvesting	1'33						
Yuca							
Clean Land	0'14						
Plant	0.14						
Weed	0.28	1.40	0.70				
Harvest	0.14	1.40					
Bananas							
Plant	0.15		0.23	0.23			
Weed	0.66		3.30	3.30			3.30
Harvest	0.51	2.04	2.04	2.04	2.04	2.04	2.04
Coca							
Plant	0.16	7.60	7.60				
Weed	0.66	4.95		4.95	4.95		4.95
Harvest	0.50		8.75	8.75		8.75	8.75
Citrus							
Plant	-						
Weed	0.37				1.22	1.26	1.22
Harvest	0.19	1.90					
Other (Annual Crop)							
Plant	0.40				1.06	1.07	1.06
Weed	0.40					2.13	2.14
Harvest	0.40						
Other (Perennial Crop)							
Plant							
Weed	0.40				2.00	2.00	2.00
Harvest	0.40	3.20	3.20	3.20	3.20	3.20	3.20
Total		36.49	39.22	26.47	20.72	28.83	35.71
Full Time Labor Available		50.00	50.00	50.00	50.00	50.00	50.00
Surplus/Deficit		13.51	10.18	23.53	29.28	21.17	14.29

* For a discussion of the assumptions that were used to develop this table see annex No. 8

Table III B-6 (Continued)

Farm Labor Profile on Typical Farm For Chapare *

Crop & Activity	Jan.	Feb.	Mar.	April	May	June	Total
Rice							
Land Clearing						14.00	46.00
Planting							6.65
Weeding	3.59						18.62
Harvesting		10.64	11.97	10.64			33.25
Yuca							
Clean Land			0.70	0.70			1.40
Plant				0.14	0.14	0.14	0.42
Weed					0.70	1.40	4.20
Harvest					1.40	1.40	4.20
Bananas							
Plant	3.30						6.46
Weed	3.30		3.30	3.30			19.80
Harvest	2.04	2.04	2.04	2.04	2.04	2.04	24.48
Coca							
Plant							15.20
Weed	4'95		4'95	4.95		4.95	39.60
Harvest		8.75	8.75		8.75	8.75	70.00
Citrus							
Plant							-
Weed		1.22	1.26	1.22			7.40
Harvest				1.90	1.90	1.90	7.60
Other (Annual Crop)							
Plant							3.19
Weed	2.13						6.40
Harvest	4'00	4'00	4'00				12'00
Other (Perennial Crop)							
Plant							12.00
Weed	2.00	2.00	2.00				38.40
Harvest	3.20	3.20	3.20	3.20	3.20	3.20	371.27
Total	25.21	31.85	42.17	28.09	18.13	37.78	
Full Time Labor Available	50.00	50.00	50.00	50.00	50.00	50.00	600.00
Suplus/ Deficit	24.79	18.15	7.83	21.91	31.87	12.21	230.73

* For a discussion of the assumptions that were used to develop this table see annex No. 8.

While Table III B-6 shows the estimated labor use for a typical Chapare farm, as Table III B-2 indicates, there is substantial variability in cropping patterns over the Chapare. As the land use pattern in the areas of new crop emphasis varies, so too would one expect the labor use pattern to vary. Using the same methodology as in Table III B-6, farm labor use was calculated for an average farm in each program area (i.e. cacao, rubber, tea, pineapple and pejibaye). The results are shown in Table III B-6a.

Comparing labor use with labor availability, it would appear that, at least for the average farm, there are no deficit labor periods in any of the regions. The closest any month comes to being in deficit are June in the tea program area and March in the rubber, tea and cacao program areas.

The finding that there are no labor deficits may appear somewhat surprising given the fact that labor migrates to the Chapare for work, particularly in the March-July period. However, one must remember that the above calculations are for an average farm with an average labor availability of 600 days per year. There are, however, many farms above average in size as well as farms below average in labor availability. An analysis of average farm sizes in the different program areas reveals substantial acreage variability in any area. For example, while the average crop area is 4.85 hectares in the proposed rubber program areas the average by sub-areas ranges from 3.85 to 6.33 hectares. Also, in the rubber

program areas, the area planted to coca, a labor intensive crop, varies from 0.25 hectares to 1.57 hectares, with an average area of 0.77. Hence, there is not necessarily any conflict between the existence of labor hiring and the showing of labor surpluses on the average farm.

To summarize, the data in Table III B-6a shows that surplus labor is available in each month of the year although the amount available varies from month to month and by program area. The next step in the present analysis is to examine the labor requirements of the proposed new activities to determine to what extent labor will be a potential limiting factor to their acceptance.

- Labor Requirements for New Crops

In addition to the area emphasis on new crops (rubber, cacao, tea, pineapple and pejivalle), there are Chapare wide programs for introduction of new crop rotation systems, involving legume ground cover and livestock production, that will affect labor use requirements. The monthly and annual labor requirements for both the new crops and the new rotation system are described in Annex No. 9.

Table III B-6b presents a summary of this data, showing the annual per farm labor requirements associated with each activity, from the initiation of the activity until it achieves its targeted level. As can be seen rubber and tea require the most labor, with both requiring over 200 days per year when in full production.

Using the data in Table III B-6b in conjunction with the annual labor requirements for current crops by program area as shown in Table III B-6 it is possible to estimate farm labor balances for each program area, assuming that the new crops are added to the existing cropping pattern without any reduction in the area of present crops. Table III B-6c presents the annual farm labor balance for each program area.

The labor balances in Table III B-6c include, in addition to the labor requirements for the emphasis crop in a given area, the labor requirements for the crop rotation, forage and livestock activities. While not all of these activities will be undertaken on every farm in every area of the Chapare, they were included in the calculations in order to help identify their compatability with the other programs.

Table III B-6c shows that, with exception of rubber and tea, the addition of the new crops does not result in negative labor balances even when the rotational forage and livestock activities are included. In the case of rubber and tea, if the rotational forage and livestock activities are excluded the labor deficits are either eliminated (rubber) or significantly reduced (tea). Whether a farmer might attempt to balance labor availability and need by not adopting some or all of the rotational, forage and/or livestock activities remains to be seen. He also has the option of reducing the area of some of his present crops, thus freeing labor to meet the projected deficit. An alternative strategy a farmer could pursue is to hire additional labor. This labor could come from labor surplus farms in the Chapare and/or, in the March-August period,

from labor surplus farms in the Cochabamba valley.

Table III B-6a

Estimated Monthly Labor Use for an Average Farm in Each New Crop Emphasis Program Area (in Man-Days)

Program Area	July	Aug.	Sept.	Oct.	Nov.	Dec.
Rubber	37.22	44.27	29.36	23.68	31.04	39.83
Pineapple	23.76	27.82	19.38	16.27	23.17	26.73
Tea	32.18	39.13	31.97	22.07	31.13	40.06
Cacao	27.49	32.46	22.87	24.08	31.48	36.27
Pejibaye	30.73	37.08	25.39	20.66	28.53	34.98

Program Area	Jan.	Feb.	Mar.	April	May	June	Tot.	%Use*
Rubber	27.25	33.13	44.27	32.83	22.03	41.39	406.30	67.7
Pineapple	18.57	25.86	32.68	20.02	13.03	31.16	278.48	46.4
Tea	23.09	33.53	45.75	28.94	24.85	47.12	399.82	66.6
Cacao	26.79	35.88	46.04	33.77	14.26	33.14	364.53	60.8
Pejibaye	24.03	30.68	39.29	28.25	19.33	37.56	356.51	59.4

* Total man days as percentage of estimated 600 man days of family labor available per year.

Table III B-6b

Per Farm Annual Labor Requirements Associated With The Proposed New Production Activities From Program Initiation to Attainment Of Targeted Level

Production Activity	(Year) 1	2	3	4	5	6
Crop Rotation	25.9	44.9	44.9	44.9	44.9	44.9
Forages	3.0	11.0	11.0	11.0	11.0	11.0
Livestock	-	8.0	24.0	48.0		
Rubber	121.0	170.0	90.0	90.0	131.0	200.0
Tea	70.0	54.5	71.5	121.5	176.0	175.5
Cacao	42.0	71.5	93.75	110.0	132.5	119.0
Pineapple	74.0	21.0	134.8	135.0	197.4	21.0
Pejivalle	85.5	52.5	76.5	86.5	88.5	88.5

Production Activity	(Year) 7	8	9	10	11	12
Crop Rotation	44.9	44.9	44.9	44.9	44.9	44.9
Forages	11.0	11.0	11.0	11.0	11.0	11.0
Livestock	48.0	48.0	48.0	48.0	48.0	48.0
Rubber	228.0	228.0	228.0	228.0	228.0	228.0
Tea	243.5	219.5	207.5	287.5	255.5	207.5
Cacao	121.0	133.3	153.0	166.5	174.0	178.5
Pineapple	134.8	135.0	197.4	21.0	134.8	135.0
Pejivalle	88.5	88.5	88.5	88.5	88.5	88.5

Table III B-6c

Annual Farm Labor Balance For A Typical Farm In Each Program Emphasis Area Assuming The New Activities Do Not Replace Present Crops

Area	0	1	2	3	4	5	6
Rubber	193.7	-2.2	-53.6	56.4	83.4	35.4	-10.
Tea	200.2	106.3	86.8	43.6	20.8	-33.7	-33.
Cacao	235.5	164.6	100.1	77.2	72.2	49.7	63.
Pineapple	321.5	268.6	256.6	188.2	214.2	139.9	256.
Pejivalle	243.5	129.0	128.1	100.1	95.1	95.1	95.

Area	7	8	9	10	11	12
Rubber	-48.6	-48.6	-48.6	-48.6	-48.6	-48.6
Tea	-101.2	-77.2	-65.2	-145.2	-113.2	-65.2
Cacao	61.5	49.2	29.5	16.1	8.5	4.0
Pineapple	188.2	214.2	139.9	256.6	188.2	214.2
Pejibaye	95.1	95.1	95.1	95.1	95.1	95.1

7. Crop Production in the Chapare and Farmer Income

The data on both hectares under cultivation by crop and on yields per hectare is questionable. Different sources (MACA, PRODES, OAS) provide materially different numbers and there is no basis for assessing their accuracy. For purposes of this analysis, we are using a series of estimates on area in production by crop[7/] made by the PRODES representative in Villa Tunari, Ing. Karl Hoffmann, a man with long and intimate acquaintance with the region. His data are shown in Annex No. 2.

For yields per hectare we are using the data in a study by Figueras of the University of Florida [8/] adjusted as follows for perennials in order to take into account crops which have been planted but are not yet in production: the estimated total yield during the producing years divided by the total estimated life of the tree or base from planting. [9/]

Price data used is a four year average (1976-79) based on information provided by Ing. Karl Hoffman. In the case of coca, any price figure is subject to gross error. In 1978 the price per "carga" (approximately 110 Kg.) varied between 600 and 1,200 pesos. This year the reported variations are from 1,000 to 4,000 pesos per "carga" with some of the fluctuation due to seasonal factors.

7/ Using averages for spontaneous and directed colonization units Combined from Annex No. 2

8/ Figueras, J. Antonio: "El Chapare: Sus Recursos y Sus Usos", Misión Universidad de Florida en Bolivia, 1976-1978

9/ We believe that Figueras' figures on life of citrus trees may be too high, but we have used them.

Thus the 1,600 pesos per carga figure we are using is somewhat arbitrary.

Cost data, which is primarily labor, was calculated at the going rate of 50 pesos per day.

When the above defined area, yield, price and production cost data are combined, the results are shown in Table No. III B-7. As can be seen this results in an average gross farmer income of US$ 3,529 and an average net farmer income of US$ 2,580, with 59% attributable to coca.

Several comments are in order:

1. There is very little physical evidence in the Chapare of this level of income. One simply does not see the motor-cycles, power saws, clothing, etc., that would be expected if a large number of farmers were receiving this kind of cash income.

2. Informal spot checks with a small (non-statistically valid) selection of farmers in the 9 micro-regions indicates that there are probably very significant distortions in income distribution. It appears that income is a function of: (a) length of settlement; (b) access to all weather roads; and (c) crop mix. The suspicion is borne out by reports that in the Chapare Branch of the Banco de Cochabamba, the number of savings accounts remain small -- in the low hundreds -- but that the aggregate value of these

accounts has risen sharply to approximately $b. 3 millions. In sum, we suspect that there are a small number of farmers --possibly between 1,000 and ',000 -- who have incomes over 300% of the average shown on Table III B-7 and that the overwhelming majority of the farmers in the region have incomes well under US$2,580.

Table III B-8 which uses the same basic data, attempts to show the aggregate production and gross value of that production for the region as a whole. Coca, which represents 15% of the cultivated area, accounts for 52% of the value of production while rice, which accounts for 31% of the area in cultivation, produces 8.7% of the total value of the crops.

We have attempted to cross check these aggregate production values with the data given by Medina 10/ who based his information on internal customs figures at the Villa Tunari/Cochabamba check point. There is absolutely no correlation, either in absolute numbers or in distribution of the total value by crop. It is clear that much remains to be done in the area of basic economic research.

10/ Medina Rubio, Edilberto: "Estudio de Mercadeo del Area del Chimore", IICA - PRODES, 1979.

Table No. III B-7

Crops, Area, Yield, Incomes, and Costs of Production for a Typical Farm in the Chapare

(in Bolivian pesos)

CROP	HAS.	YIELD Per Ha.	UNIT PRICE	TOTAL INCOME	SEED AND PLANTING COST	WEEDING COST	CHEMICAL APPLICATION ****	HARVESTING COST	TOTAL COST	NET INCOME
Rice	1.33	33 qq	140/qq	6,145	(29)*1,654	(20)1,000	(17)1,015	(14) 700 (8) 400**	4,369	1,776
Coca	0.66	35/cargas	1600/carga	36,960		(40)2,000		(93)4,650	6,650	30,310
Banana	0.66	280chipas	32/chipa	5,914		(21)1,050		(28)1,400	2,450	3,464
Citrus	0.56	800(100s)	35/100	15,680		(18) 900		(37)1,850	2,750	12,930
Other*** crops	1.09			5,886	(9)525	(15) 750		(30)1,500	2,775	3,111
Total Crop	4.3			70,585					18,994	51,591

* Numbers in parenthesis = Man days of labor
** Second year rice crop - less production than first year crop.
*** Such as corn, yuca, papaya and tomato
**** Including cost of chemical
Monetary unit: Bolivian peso. $b 20 = US$1.00

Table III B-8

Aggregate Production and Value of Production in the Chapare

Crop	Hectares in Production	Yield per Ha.	Production	Price (Pesos) per Unit	Value in thousand P.	% of Total Value
Coca	7,310	35 cargas	255,850 ca.	1,600carga	409,360	52.0
Rice	14,747	33 qq	486,651 qq.	140 qq.	68,131	8.7
Banana/Platano	7,305	280 chipas	2,045,400 ch.	32 chipas	65,453	8.3
Citrus	6,155	800 (100s)	4,924,000 (100s)	35/100	172,340	21.9
Papaya	475			5,400 per Ha.	2,565	.3
Other	11,570			6,000 per Ha.	69,420	8.8
	47,562				787,269	100.0

8. Marketing

More than 80% of the agricultural produce of the region is sold via intermediaries in the Cochabamba market. Their functions are described in general below, but is should be kept in mind that no hard and fast distinction are maintained and that there is a good deal of overlapping.

(a) The "rescatista" is a small-scale wholesaler having established relationships with a group of farmers from whom he buys small quantities either in the field, at roadside or in the local markets. He does not normally own his own trasport. His customers will be other "rescatistas" or "mayoristas".

(b) The "mayorista" is a wholesaler who buys substantial quantities of produce, e.g. in the case of oranges in truckload lots, from farmers, "rescatista" or other "mayoristas" with whom they have established relationships. "Mayoristas" who deal in the Cochabamba market are usually allowed space in La Cancha, where they sell to "minoristas" and to some extent, to "rescatistas" or "mayoristas" serving other markets. Approximately one quarter of the Cochabamba "mayoristas" own their own transport; practically all those who deal in other markets such as Oruro or Potosí own their own trucks.

(c) The "transportista" provides a trucking service from the Chapare to the Cochabamba market on behalf of the farmer and one or more wholesalers, "rescatistas" or "mayoristas", with whom he has established relationships. The "transportista", like the "mayoristas", has capital and can pay cash to the farmer. Consignment sales are not uncommon where an established relationship exists, and in such cases the "transportista" charges a fixed amount for his services and delivers the balance of the wholesale price to the farmer on his next trip.

(d) The "minorista" semi-retails small quantities of produce to shops - "tiendas" or "ferias" - and retails directly to the consumer.

The following points are in order:

(a) The consumer faces a minimum of four and up to a maximum of seven steps in the marketing process; most notable is the inefficiency of the system at

retail level where the duplication of services performed by a multitude of "minoristas" causes otherwise unjustified retail margins;

(b) The farmer, who sells his product directly in the field or at the nearest roadside, is more or less at the mercy of the intermediaries with whom he has to deal (only a very small percentage of his product is marketed directly in Cochabamba, usually by the farmer's wife when she goes to town to buy clothes, domestic items or tools);

(c) At the farm level, sales are usually effected by visual inspection; if scales are used, they are the property of the intermediary and are often alleged to have been tampered with.

Some products of the Chapare - rice, coca, corn, and pork - are subject to prices which are fixed at the retail level by the Ministry of Industry and Commerce. Others, such as citrus, bananas and plantains, pineapples and yuca are not controlled. Taxes are levied on all produce leaving the Chapare according to quantity and market value. The Aduana Agropecuaria del Departamento de Cochabamba (the inland agricultural customs of the Cochabamba Department) collect taxes in Paracty and in Cochabamba on coca, wood and fruit in general. The proceeds are used primarily for roads (nearly 51%) and the balance goes to various social services, the University of San Simón de Cochabamba, the Prefecture, the customs police and the customs administration itself. Taxes vary by product; on coca, 10 pesos per costo (25 lb.); fruit, rice and wood 1 peso per quintal (100 lbs.); coffee 21 pesos per quintal.

Rice and fruit represent 52% of the taxes collected by the Aduana Agropecuaria del Chapare in 1977, coca 30% and wood 17%. The transporter-traders make every effort to avoid these taxes; some observers estimate a success rate of 50%.

- Transport

The transporters of the Chapare belong to the Sindicato de Transportistas del Chapare (850 members, approx. the same number of vehicles), whose members have the exclusive right to enter the area and to offer their services. (They cannot do authorize the entry of truckers belonging to Sindicatos from other cities). The Sindicato functions as a means of equalizing the distribution of freight loads among its members, and as a pressure group in exercising influence on the authorities to maintain and increase freight rates.

Heavy trucks travel between Cochabamba and Puerto Villarroel irregularly depending upon whether or not there are shipments for the Beni and vice versa for Cochabamba. It is not unusual for a transporter to wait 7-15 days to pick up a load.

As mentioned above, the transporters negotiate directly with farmers for a specific load, and, reportedly, often charge more than the official tariff. By reason of the Sindicato's transport monopoly and the fact that in many cases the transporter also functions as an intermediary, the transporter and/or his principal have considerable influence in setting prices paid to the farmer as well as freight rates, in spite of the fact that the

latter are theoretically fixed by the government.

The transporters divide up the area among themselves, resulting in (a) a lack of competition between them, and (b) in a definite reluctance to service the more remote areas. Even so it can be said that with the exception of areas of floodwater in the Northern Chapare there is no conspicuous lack of transport.

The list of freight rates in Table III B-9, according to a recent study 11/, reflects the real rather than official tariffs. It is noticable that the Cochabamba/La Paz truck rate is significantly higher than the railroad rate and also that the Villa Tunari/Cochabamba and Cochabamba/La Paz truck rates are equal, even though the latter distance is double the former and the road conditions are much worse.

11/ Hanrahan and Hoffman: "Citrus and Tropical Fruits Study" (draft version USAID, 1979.

Table III B-9

CHAPARE: Costs of Transport 12/

(Pesos per hundred/weight)

Truck	Villa Tunari	Cochabamba	12
	Cochabamba	Oruro	9
	Cochabamba	La Paz	12
	Cochabamba	Sucre	14
	Cochabamba	Potosí	22
	Cochabamba	Tarija	39
River Boat	Puerto Villarroel	Trinidad	16
	Trinidad	Puerto Villarroel	14.8
Rail	Cochabamba	La Paz	7.9
	Cochabamba	Ollague (Chilean frontier)	11.7
	Cochabamba	Charaña (Chilean frontier)	11.1

12/ SOURCE: Figueras, Juan Antonio: "El Chapare: Sus Recursos y Sus Usus". Misión de la Universidad de Florida en Bolivia, 1978.

- Margins:

The analysis shown in Table III B-10 indicates that:

a) Returns to the farmer appear reasonable from a percentage standpoint: the problem of low average income lies in low yields and volumes, and is partially compensated for by coca production:

b) Wholesale margins are not excessive; the cost of transport is high but probably in line given the cost of trucks and the bad condition of the roads inside the Chapare.

c) Retail margins are inflated by the fact that there are too many operators at the retail level, selling in such small quantities as to be inefficient.

Table III B-10

Analysis of Margins by Crop 1/

	RICE		CITRUS COCHABAMBA		CITRUS SUCRE/ POTOSI		PLANTAINS & BANANAS COCHABAMBA	
Production Cost	134	Q	8	C	8	C	23	CH
Farm Price	160		35		35		32	
Farm Profit	26	16%	27	77%	27	77%	9	28%
Wholesaling costs	21		8.55		15.45		31.60	
Transport	10	(net)	5		10		24	
Taxes	1		0.25		0.25		2.40	
Losses	8	5%	2.80	8%	4.20	12%	3.20	10%
Expenses	2		0.50		1		2	
Wholesale price	195		48		60		70	
Wholesalers profit	14	7%	4.45	9%	9.55	16%	6.40	9%
Processing costs	15							
Processor's price	240							
Processor's profit	30	12.5%						
Retail costs	7		8.80		9.80		25	
Transport	1		1		1		3	
Losses	2		3.80	8%	4.80	8%	14	20%
Expenses	4		4		4		8	
Retail price	620		100		100		144	
Retail profit	366	59%	44	44%	31.20	31%	49	34%

1/ Medina Rubio, Edilberto: "Estudio de Mercadeo del Area del Chimoré" IICA/PRODES, 1979

Q=100 Lbs. C=100 units Ch.=720 Units U.=Unit J=120 Units (Jaba)*La Paz

A = 25 Lbs.

Table III B-10 (cont.)

Analysis of Margins by Crop 1/

	PLANTAINS & BANANAS ORURO/SUCRE		CORN		YUCA		PINE-APPLE		PAPAYA	
Production Cost	23	CH	82	Q	8	A	0.70	U	139	J
Farm Price	32		90		15		2		160	
Farm Profit	9	28%	8	9%	7	47%	1.30	65%	21	13%
Wholesaling costs	50.80		22.50		9.65		1.16		77	
Transport	40		12		6		0.60		30	
Taxes	2		1		0.65		0.11		1	
Losses	4.80	15%	4.50	5%	1.50	10%	0.30	15%	40	25%
Expenses	4		5		1.50		0.15		6	
Wholesale price	100		170		35		3.62		260	
Wholesalers profit	17.20	17%	57.50	34%	10.35	29.5%	0.46	13%	23	9%
Processing costs										
Processor's price										
Processor's profict										
Retail costs	31		5				0.65		31	
Transport	3		1				0.05		1	
Losses	20	20%					0.55	15%	26	10%
Expenses	8		4				0.05		4	
Retail price	198		217				6		600	
Retail profit	67	34%	42	19%			1.73	29%	309	51%

1/ Medina Rubio, Ediliberto: "Estudio de Mercadeo del Area del Chimoré" IICA/PRODES, 1979

Q=100 Lbs. C=100 units Ch.-720 Units U.Unit J=120 Units (Jaba)*La Paz

A=25' Lbs.

- Packing of Fruit in the Chapare

As shown in the glossary (Annex No. 3), most Chapare citrus is packed "a granel", as are "hands" or stems of bananas and plantains, in the latter case the hands are placed individually in the truck in such a way as to reduce movement and limt damage. Papayas are normally packed in "jabas", "cajones", "canastas" or even loose, as is the case with pineapples and watermelons.

Of the types of fruit handled, only oranges, bananas and plantains reach full truckload shipments. Even passengers travel on top of mixed loads.

There also seems to be a problem with certain forms of packaging in that inland customs charges are higher for packaged fruit than for loose-packed fruit.

- Grading in Bolivia

The Bolivian consumer is not particularly discriminating at the retail level beyond rejecting or paying less for damaged or obviously defective fruit. Size normally governs price, although different varieties of bananas/plantains will bring different prices at retail. Again, variety may be an influence on size and therefore on price.

What little retail grading exists is done by the seller, whereas at wholesale all sizes and qualities are mixed and sell at the same price, this in spite of the fact that graded, well-packed and uniform Argentine apples and pears are well-known and widely sold in the market.

Further up the marketing stream, attempts have been made by the fruit processing companies, export brokers and extension agents to induce growers to grade their products or to sell the best part of their crop at a premium price - without success. Grower resistance derives from two sources:

a) Even if the better-quality fruit brings a higher price , they are convinced that the total return will be lower; and

b) Tree-pickers are paid by the 100 units of fruit; if the best fruit is picked first, the tree will have to be picked twice, the picking will be slower, the picker makes less money and charges the grower more per 100, significantly increasing his costs.

In sum, a recent study of the problem 13/ concludes that "there is in Bolivia a marked psychological resistance to grading on the part of all elements in the marketing chain".

13/ Hanraham and Hoffmann, Op. Cit. 1979

- Demand at the National Level and Abroad:

The areas closest to the Chapare which provide domestic markets for its products are the Department and city of Cochabamba, the Department of Oruro and the mining centers; and for export, Perú, Argentina, Uruguay and Chile.

The existing crops of major interest are rice, citrus, plantains and bananas, corn yuca, pineapple and papaya. Available information regarding production, supply and demand for each of these crops are given in Annex No. 4. The following comments by crop are in order:

a) Rice: From an economic standpoint, rice is a difficult crop in Bolivia: it is a staple of both rural and urban diets, but nobody makes much money on it. A distorted supply-demand relationship at the national level is apparently beginning to balance out. It is noteworthy that the Chapare, with approximately 1% of the population of the country, accounts for 16% of the national demand for rice in 1979. This serves to point up the dependence of the colonists on rice, especially during the first years of settlment.

b) Citrus: The supply-demand relationship for citrus shows persistent surpluses, which may be accounted for by understimation of losses at every level of the process of moving the product from farm to consumer.

c) Plantains and Bananas: The figures shows surpluses crossing over to shortage in about 5 years. Note that the figures shown for losses do not agree with those given in the sub-section on system losses because farm consumption and losses are given here as a single aggregate.

Small quantities of bananas are now exported to Nothern Argentina. There may be possibilities for exporting chilled bananas to major population centers once the new road to Santa Cruz is terminated. A marketing feasibility study is indicated.

d) Corn: The principal demand for corn in the Cochabamba department is for poultry and pig feeding, less for corn flour and "chicha". National figures are considered unreliable and are not given. Moreover, the lack of historical series makes projections very hazardous.

e) Yuca: In the case of yuca, which is not strictly a perishable item, as it can be stored in ground for up to two years, the available figures show persistent surpluses and very large on-farm consumption. On the other hand, there is general agreement among observes that active retail markets exist only in certain provinces where consumption is high, such as Santa Cruz, Cochabamba, La Paz, Beni and Tarija. In the rest of the country, yuca is hardly consumed at all. Some form of industrialization of yuca is obviously indicated. The surplus balances shown in Annex No. 4 are arrived at by subtracting marketing losses and demand from the supply column.

f) Pineapple: There are no available figures for national or departmental demand for pineapple. The Chapare figure represents new plantings of Brazilian varieties in the Mariposas area which are much superior to the local. There are definite export possibilities, particularly to Argentina.

g) Papaya: Recent figures for the Chapare are not available, which tends to make the national figures suspect. No quantification of demand has been possible. There is a potential market for papaya extract both domestically and for export.

- Conclusions About Demand for Current Production

a) In the Chapare: Local demand for the products of the area is limited by the fact that farmers are growing subsistence crops; what demand there is comes primarily from people in the villages, such as Villa Tunari, Villa 14 de Septiembre, Germán Busch, Chimoré, Ivirgarzama and Puerto Villarroel, where there are open markets, or "ferias", on Sundays.

b) On the National Level and Abroad: The areas closest to the Chapare in which there exists demand for its products are the Department and city of Cochabamba, the Department of Oruro and the mining centers; and as for exports, Perú, Argentina, Uruguay and Chile. In this connection, it should be noted that the short-run prospects are not very promising: 1) in the domestic markets because of limited growth in population and in income per capita; 2) in foreign markets because of the absence of com-

parative advantage (except in coca production).

As to the domestic market, the following comments are pertinent:

a. The peasant sector, which includes almost all the rural population, does not play a demand role in the commercial market for agricultural products, but produces its own needs for consumption and seed; consequently the domestic market consists essentially of 5-6 towns and the mining areas.

b. It is government policy to protect urban, mining and other special interests by price controls, which keep down the prices of agricultural products in the cities. Urban salaries have also been frozen.

c. The population growth rate is relatively low as is the income elasticity of demand. Furthermore, consumer behavior shows little or no discrimination with respect to the quality of the product.

d. The foregoing conditions have brought about a situation in which: (a) the population is in general able to satisfy its needs and desires for a range of agricultural products, although there have been substantial increases in retail prices, some of which are due to shortages in supply and (b) there does not exist any great social pressure to improve the conditions or behavior of the agricultural sector.

e. It should also be noted that agricultural products in general are subject to low price elasticities of demand, with the consequence that overproduction could lead to reductions in farm income.

As to foreign markets for current production, the geographic situation of Bolivia and the inferior state of its internal communications make for high transport costs and necessitate concentration on high quality products with a high price-to-weight ratio . With a very few possible exceptions, e.g. bananas for the Argentine market, this requirement is not met by any of the products presently produced in the Chapare.

- Action Program

To sum up, an action program should include the following elements:

a. Market education of the farmer, with a view to avoidance of saturation as in the case of rice and sugar. For reasons of cost and quality, surpluses can not be exported, and in spite of falling local prices the farmers continue to increase production.

b. Improvement of internal storage, handling and transport mechanisms so as to reduce losses, with the benefits of the improvements being returned to the farmer.

c. Increase in value added at the rural level through processing of certain products with relatively simple technology.

d. Provision of current price information to the farmer.

9. Agro-Industry, Farm Input Supply, and Forest Products

While the term may have a broader meaning elsewhere, "agro-industry" in Bolivia refers to commercial plants processing farm products in some manner. Forest product industries are also mentioned.

- Rice Milling

This is the only agro-industry established in the Chapare. The existing rice mills in the Chapare are listed below. 14/ All except the two Villa Tunari mills are small, rustic operations used primarily for local consumption needs.

LOCATION	CAPACITY
Villa Tunari	200 qq/day
Villa Tunari	200 qq/day
Ivirza (3)	20 - 80 qq/day

14/ SOURCE: Medina, Op. Cit. 1979

LOCATION	CAPACITY
Mariposas	
Valle Hermoso	
Puerto Villarroel	
Chaequi	
Ivirgarzama	
Chimoré	

The two Villa Tunari mills are the only ones with sufficient capacity to serve Cochabamba markets.

One, originally a cooperative organized by the Banco Agricola de Bolivia, is currently owned by private interests. It is not currently operating and condition of the equipment is not known. The mill was built in the mid-sixties. The plant has no storage for rough rice and its reported milling capacity is 200 qq (8.9 MT.) per 8 hour day. What drying facilities the plant may have in unkown.

Without storage facilities for rough rice, this mill is limited to 4 months operation a year during the Chapare rice harvest. Thus on a one - shift per day (20 days a month) basis the annual capacity of the mill is 712 MT, or on a two shift basis 1424 TM. With appropriate rough rice storage it could operate 11 months of the year with an annual production of 1958 MT on a one shift basis.

The other Villa Tunari mill, Agrigento Ltda., is owned by La Paz interests. The facilities and equipment are less than 5 years old and appear to be in good operating condition. There is no rough rice storage. Reportedly, there is drying equipment (capacity unknown) and milling machinery with a capacity of 200 qq (8.9 MT) a day . Comments on the first mill with respect to production also apply to this one.

The plant has been operating at a level much below its capacity. Colonists report that the plant will not provide drying and milling services on a fee basis, under instructions from the owners. Reportedly the plant has not been profitable. The principal reason being given as "management problems". It is for sale, reportedly at US$100,000, substantially below replacement cost.

In terms of the Cochabamba market, there is room for operation of both the Villa Tunari mills. Conversely, there is no need for additional milling capacity. However, neither can operate profitably without investment in storage facilities, efficient "on the spot" management, and adequate working capital. While not proposed for financing under this program, the Area Development Authority might play a promotional role in attempting to put together a financial and management package to take advantage of the existing facilities.

It should be noted that the MACA/CORDECO/INC-GAS Chapare Project team has developed a proposal for installing a new rice drying, milling and storage

operation with a capacity for 7,800 metric tons annually (65% of current production in the Chapare).

Investment required is US$ 1.55 million. Projected returns on equity start at 17% in the first year and reach 39% by the 10th year of operation.

We have not included this proposal in the recommended program, because: (a) The rehabilitation of the 2 existing Villa Tunari plants would provide the Chapare producers with essentially the same capacity at less cost; (b) For the Cochabamba area as a whole (including the Chapare) there is substantial over capacity in the rice processing industry; (c) The proposal, as designed, would provide no direct benefits to the small farmer, if the projected profit margins are to be obtained.

- Palm Hearts

Up until a year or so ago, there was a portable plant located in Puerto Villarroel for canning palm hearts from wild palms. This plant was canning 20 cases a day, each case containing 24 cans of 500 gr. each. The plant has been moved to the Beni.

DILLMAN, a major Bolivian canner, also cans palm hearts from wild trees in its plant at Cochabamba. He is interested in a larger and more regular supply. The proposed program includes a component on stimulating production of Pejivalle palms for this purpose.

- Farm Input Supply

To date there has been little demand for farm inputs such as fertilizers, herbicides, insecticides and equipment. Consequently, development of supply channels in the Chapare has been minor. For most inputs, Cochabamba is the nearest source. However, there is increasing interest in some chemical inputs (e.g. herbicides), application equipment, and chain saws. Also, the proposed program will develop very substantial additional input requirements. Actions are proposed, as part of the program, to establish in-put supply mechanisms to deal with the anticipated demand.

- Forest Products

Sawmills in the Chapare area are listed below. 15/

LOCATION	CAPACITY
Villa Tunari	2500 BD. FT/DAY
Ivirgarzama	2000 BD. FT/DAY
Cesarzama	1300 BD. FT/DAY
Ivirgarzama	1000 BD. FT/DAY
Ivirgarzama	1000 BD. FT/DAY
Puerto Alegre	not known

15/ SOURCE: Medina, Op. Cit. 1979

The principal woods used are Coloradillo, Sangre de Toro, Ochoó, Laurel, Palo Maria and Madera Blanda.

The sawmill in Villa Tunari, whose owners also have wood products operations in Cochabamba, has modern machinery. The mill buys trees from colonists for 40 to 100 pesos per tree and sells lumber in Villa Tunari for 3 to 4 pesos per BD. FT. and in Cochabamba for 5 to 6 pesos per BD.FT. 16/

CORDECO has studied the possibility of establishing a charcoal industry in the Chapare. 17/ However, in discussions, we were informed that they had concluded that eucalyptus was the preferable wood for making charcoal and that it was not available in the Chapare.

There have been several other studies 18/ which propose such items as a pulp mill. We have not been convinced as to the validity of these proposals. The only new forest products industry proposed is for a fruit packing crate plant. The details of this proposal are found in Chapter V G.

16/ Figueras, Op. Cit. 1978

17/ "Producción de Carbón de Leña - Villa Tunari", CORDECO (1975).

18/ Bazán Flavio, Cruz Andrés: "Recursos Forestales del Chapare y su Potencialidad", Proyecto Chapare MACA, Inc. CORDECO/OEA, 1979

- Proposed New Agro-Industries

We have examined and discarded several candidates for new agro-industries to be installed in the Chapare, developed by the MACA/CORDECO/INC-OAS Chapare Project Team, while retaining one proposal. The rejected proposals are as follows:

Dehydration of Forage: The proposal is based on a current demand by the Cochabamba dairy and poultry industries for 21,000 MT. per year of forage imported into the Area. There is no issue about the market. The project proposes to install a plant with a 5,800 MT. per year capacity. The financial requirements to construct and put the plant in operation are estimated at US$ 525,000. Using the small farmers as a raw material production source, the MACA/CORDECO/INC-OAS team concludes that the project is not economically viable. Neither is it particularly profitable to the farmer. We agree with these conclusions. The above team goes on to indicate that the project might be profitable if the entire enterprise was operated on a plantation basis (4-500 hectares). The Area Development Authority, as part of its broader promotional functions, may wish to investigate this matter further. However, as an element in the AID supported program, this potential agro-industry cannot be recommended.

Orange Sorting and Grading: The proposal is to set up a facility to collect, place in covered storage, wash and desinfect, and then sort oranges into

3 grades (for export, for Bolivian urban markets, and for bulk sale in Cochabamba markets and to processors). The first two grades would be waxed and appropriately packed. The financial requirements are US$ 300,000. The return on equity is high, reaching 90%.

We have several doubts about the return on equity; first, the price it is proposed to pay to producers (28 pesos per 100 units) is significantly lower than the current price (35 pesos per 100 units); secondly, the estimated unit cost of boxes is about 1/3 of what we believe that cost will actually be.

Our main reasons, however, for not endorsing this proposal are as follows:

a. A better quality orange must be produced before grading and price differentials make sense. Under the citrus production activity proposed in the program, it will be minimum of 6 or 7 years before there is any appreciable quantity of the new varieties in the market place.

b. For the project to be successful, a Bolivian market for quality oranges at a quality price must be developed. We have some doubts as to this happening.

c. We believe it unrealistic to assume that the Cochabamba market will pay current prices (as is projected in the study) for unsorted, third grade oranges.

d. Finally, from the standpoint of the small farmer, all benefits from loss reduction and new, more lucrative markets accrue to the plant and not to the farmer.

In conclusion, we recommend that the project be restudied five years from now, and that it be restructured to take more account of the producer interest.

We have concluded that two types of new agro-industry are indicated:

a. Those which will be operated as components of the proposed vertically integrated corporations for tea, cacao and rubber (see Chapter V B for details); and

b. those which call for a different type of financial and organizational structure. Of this second type of agro-industry (in addition to the in-put supply facility and the box factory discussed earlier), the only one which we are currently prepared to propose --and, consequently, to include financing within the program --is a dehydration plant for yuca and bananas.

10. System Losses

There is a complete lack of any hard data on the magnitude and causes of product losses on the farm or at the various stages of marketing. Where estimates have been made, there is no agreement except to the extent that losses are significant and substantial. While many of the following items have been touched on in previous sections of the Report, it seemed worthwhile to summarize and attempt to quantify them.

Principal causes of significant losses would include:

a. On Farm

Fruits - harvesting methods, containers used, multiple handling and lack of care.

Grains - losses from deterioration, animals and rodents due to (i) period between harvest and threshing (rice) or shelling (corn), (ii) lack of drying, and (iii) lack of storage.

b. Transport

Farmstead to nearest road - lack of access to road pickup points, or trucks to the roads, during the rainy season.

Method of loading, handling, and unloading products on the trucks.

Multiple and rough handling at all phases.

Loose loading of trucks for many products.

Often campesino and their baggage ride to market on top of products.

Lack of adequate containers or packaging for transport and marketing.

c. Market

Multiple, and rough handling in local, Cochabamba and other markets.

Table III B-11, Estimated Losses in the Food System, summarizes references found, or the results of casual observations and conversations, with respect to the principal current crops. Loss estimates have been quantified in terms of per hectare production and peso value at farmer selling prices. If losses at the farm level can be reduced, the farmers' income will be increased at no additional cost.

A reduction of losses in subsequent phases of the food system can also substantially benefit the farmer. His buyer, and subsequent buyers in the chain, must take into account the losses they will incur before the product is resold in establishing their buying price from the farmer or preceding seller. Further, transport costs, taxes, and similar costs per unit of product sold to the consumer would be reduced.

Admittedly, reduction of losses would increase supply to the market. This might have a depressing effect on prices. However, with such a situation

the farmer, over a period of time, would devote more of his land to the production of other crops with higher returns.

Table III B-11

Estimated Losses in the Food Systems 1/

PRODUCT	ON FARM (Percentage) 2/	WHOLE SALE	RETAIL	TOTAL %	YIELD/HA.
RICE	Large	5%	-	5%	30 qq.
MAIZ	Large	5%	-	5%	20 qq.
BANANAS	16%	10-15%	20%	46-51%	280 chipa
ORANGES	Unknown	8%	8%	16% +	80,000 units
YUCA	Unknown	10%	UNK.	10% +	17.5 MT
PAPAYAS	Unknown	25%	10%	35% +	45 jabas
AVOCADO	Unknown	5%	5%	10%	8,125 units
PINEAPPLE	Unknown	15%	15%	30%	5,270 units

1/ No empirical studies have been made of product losses at the farm level or at various stages of the commercialization process. Those estimates (guesses) is perhaps a more descriptive term) are from a variety of sources, including Figueroa, Op Cit. "El Chapare, Sus Recursos y sus Usos"; Universidad de Florida Misión Agrícola en Bolivia, Documento de Trabajo No. 7 (1978). Medina Op. Cit. "Estudio de Mercado del Area del Chimoré, IICA-PRODES (1979) "Fruit Marketing in the Chapare and Yungas Zones (Preliminary Draft) Hanrahan and Hoffman, AID (1979).

2/ Percentage of production in all cases.

Table III B-11 (cont.)

Estimated Losses in the Food Systems 1/

PRODUCT	LOSS/HA.	FARM PRICE $b.	FARM VALUE OF LOSS/HA. $b.
RICE	1.65 qq	160/qq.	93+
MAIZ	1 qq	90/qq.	90+
BANANAS	129-143 chipa	32/chipa	4,122-4,570
ORANGES	12,928 units	35/100	4,515
YUCA	1.75 MT	15/arroba	2,315
PAPAYAS	15.75 jaba	120/jaba	1,890
AVOCADO	813 units	N.A.	N.A.
PINEAPPLE	1,581 units	2 units	3,162

C. POTENTIAL NEW CROPS AND/OR LIVESTOCK PRODUCTION

We have examined a series of potential new product lines for introduction on a commercial scale into the Chaparre which have been mentioned in the literature as desirable innovations towards diversification of the production of the region. (A few items such as swine and pineapple--as well as intensification of existing product lines--have already been discussed in the context of the new cropping system).

Here we are dealing with other items which, while they have to be compatible with the new cropping system, do not necessarily form an integral part of that system. Using the criteria described below, we divided these potential new product lines into three groups:

Group 1 - Products which could now be promoted vigorously on a commercial scale.

Group 2 - Products which appeared to have potential, but which needed further investigation (e.g. adaptation trials) before undertaking full scale promotion.

Group 3 - Products which were not considered to be suitable for small farmer production in the Chaparre.

The criteria used are as follows:

(a) Compatibility with new farm production systems.

(b) Appropriateness for the agro-ecologic environment of the Chaparre

(c) Suitability for small farmer production.

(d) Existence of an identifiable and adequate present, or potential, domestic and/or international market.

(e) Provision of adequate and significant returns to the producer, greater than that which he is now getting, or might be able to secure, from alternative uses of his land and labor resources.

(f) Research, technology, processing and other supporting production and commercialization inputs are available, or will be in place, when required.

1. Products to be promoted vigorously on a commercial scale

Since these crops are dealt with in some detail in Chapter No. 5 under the Proposed Program, we will only provide summary information here:

-Tea

Tea production in the Chapare is being implemented by the Nationalist Chinese Technical Mission under the auspices of CORDECO. The program is patterned after the successful experience in the Alto Beni. Taste tests conducted in Canada show that both Alto Beni and Chapare tea are of excellent quality. There are currently three nurseries having approximately 100,000 plants each. Eight hectares have been planted on 16 farms. The limited plantings seem to be yielding well under Chapare conditions without serious diseases or insect problems. The target for 1985 is to have plantings with a potential production of 106.3 MT. of black tea. Tea production is for import substitution. In 1978, import levels reached 453,353 Kg. The 1985 projected demand is 892,701 kg of which about 50% can be met from the Alto Beni, leaving approximately 450,000 Kg. to be partially satisfied from the Chapare production.

The annual net cash return to the farmer, when he is in full production, is expected to be US$ 675 for his one-half hectare of tea.

-Cacao

The Alto Beni currently produces the bulk of Bolivia's annual

cacao crop. There are some small plantings and indigenous wild cacao in the Chapare. A small nursery program is also underway. Expert studies have indicated that there are a series of micro-regions in the Chapare apt for commercial production and that, with the installation of proper drying and fermentation procedures, the Chapare product can compete on the international market, either in the form of export beans, or as semi-processed cacao products. The annual net cash return to the farmer, when in full production is estimated at US$ 800 per hectare.

-Rubber

Indigenous rubber has been traditionally harvested in the Chapare. In 1962 clones from the station at Riberalta were planted at Chipiriri and La Jota stations. These clones are growing well but have never been systematically tapped. There are also limited small plantings of rubber in the Chapare that are not being harvested or are being harvested sporadically.

With the increasing cost of synthetic rubber, it is believed that the potential demand for natural rubber will increase in the coming years. In any event, the national market can probably absorb the projected Chapare production of 1,360 tons per year by 1990.

The annual net return to the farmer when his rubber trees are in full production is estimated at US$ 892.50 per hectare in 1979 prices.

-Pejivalle

This dual purpose palm, (palm heart and/or edible fruit), is found growing wild in the Chapare. Heart of palm from these trees

and other wild palm varieties are now canned and exported in limited quantities. There is a seed source from wild pejivalle palms in the Chapare that can be utilized for establishing plantations.

The major processors, Dillman and Del Valle, both located in Cochabamba have indicated that they are prepared to buy, can and export almost unlimited quantities of pejivalle heart of palm. The tree can be handled easily by small farmers. When in full production, the annual net cash return to the farmer is expected to be approximately US$ 1,500 per hectare.

2. Products which appear to have potential but which need further investigation.

With a view towards building a base for the continued development and diversification of production in the Chapare, after the end of the proposed AID supported program, we believe it admirable to undertake now a program of adaptation trials at the farm level in selected micro-regions for the products listed below.

Only brief comment will be made here, since details can be found in Chapter V C dealing with the proposed program.

-Coconut Palm

This tree appears to be suitable for the agronomic conditions in the Chapare. The most appropriate variety is the Malayan dwarf, for which seed will have to be imported from Brazil. The domestic market prospects for coconut oil appear good. Coconuts for fresh market consumption are also being imported at present.

-Coffee

There may be some micro-regions of the Chapare where certain va-

rieties of coffee, e.g. Arabusta, can be grown competitively.

-Spices

The following spices all have excellent external, as well as domestic, market potential and, in principle, should do well in the Chapare: Black pepper, Vanilla, Capsicum Peppers and Cardamom. Of a somewhat lower priority, but also indicated for limited testing are Nutmeg, Allspice, Cinnamon and Cloves.

The potential returns to the farmer for all varieties indicated are substantial. All are suitable for small farmer production.

3. Products not suitable for small farmer production in the Chapare.

The following crops were considered and rejected -- at least at the present time -- for the reasons indicated:

-Hennas

They require a definitive dry season for optimum production and are thus not well adapted to the high rainfall conditions of the Chapare.

-Macadamia Nuts.

There is no existing or potential local market. Extensive plantings in other countries make doubtful the availability of the international market for Chapare production.

-African Oil Palm

Small farmer planting, in association with estate type production, has proved to be feasable in Malaysia. The same pattern may be possible in the Chapare. However, we do not consider it a suitable crop to start with on a small farmer basis. The Area Development Authority may wish to explore the possibility of

promoting plantation type production on one of the larger concessions.

-Ornamentals

Ornamental plants for the U.S. and other markets may be of interest in the long run. However, to be competitive, the production needs to be industrialized and the market developed with considerable care. We do not think that this is an appropriate crop for the small farmer at this time. Again, promotion by the Area Development Authority for concession type enterprise might be considered.

-Sunflowers/Safflower

In view of the potential for vegetable oil products in the domestic market, we investigated the possibility of several oil seed crops, including sunflowers and safflower. Unfortunately, the agronomic conditions in the Chapare are not appropriate for these crops.

-Poultry and Other Fowl

Large scale operations, unsuitable for small farmer operation, are necessary for commercialization on a competitive basis.

IV. THE AREA DEVELOPMENT AUTHORITY

A. INTRODUCTION

The development program proposed for the Chapare does not fit conveniently into the normal government organization framework. In most cases national agencies engage in programs, which, if not countrywide, are at least available to eligible areas. In this case, a program is proposed which cuts across the lines of authority of several different national and departmental agencies, with funding concentrated in a specific and limited geographic area in an effort to achieve rapid "integrated development".

This approach raises a number of organizational and procedural questions.

Should a special agency be established to plan and implement the program, or should it be carried out through the existing agencies? If a special agency is established, should it be virtually independent (attached to the office of the President, for example), or should it be a part of one of the existing ministries or departments? If the latter, which ministry or department? Should organizational planning be done on the assumption that the program will become a more or less permanent fixture of the Bolivian government, or should it be assumed that the program will last for only the initial five years for which financing is planned? How can the knowledge, interest and expertise of the agencies now operating in the Chapare be most effectively mobilized? Should a special Area Development Authority, if established, have jurisdiction over all social and economic development projects in the Chapare, or only those in selected sectors? Should the functions of the Area Development Authority be limited to planning, financing and monitoring the performance of the established agencies, or should it have its own work force?

These and other administrative questions are raised by the proposed program. They affect sensitive bureaucratic interests. Whatever recomendations are made will inevitably involve some reordering of the hoirarchy, and those who feel over -looked will object. In making our suggestions, we have been guided only by a desire to accelerate the rate of development in the Chapare. We regret that the recommendations cannot accomodate the wishes of all interested agencies, however admirable they may be.

John F. Kennedy said at one point, "To govern is to make choices". The following represents what we believe to be the most acceptable organisational choice among many possible alternatives, given the situation as it has been presented to us.

B. EXPERIENCE IN OTHER COUNTRIES

The idea of focusing extraordinary financial and human resources on a specific geographical area in order to accelerate economic development in that area has been tried in many countries. Some efforts have been successful and others have not. One common thread which runs through the successful efforts has been the presence of strong and sustained political and public support. Without such support, the "special" nature of the effort tends to disappear as other similar areas demand and receive similar treatment. With strong support, some remarkable results have been achieved. One such case is that of the U.S. Tennesse Valley Authority, which in a generation changed what was once an economically depressed area into one of the show-pieces of the U.S. Another is Brasil's Amazon Basin. While this effort is far from completed, it has already achieved substantial results. Other programs, while less spectacular in extent, have been equally successful. What is needed is a strong committment to development in the favored area which can be sustained for an extended period.

The administrative structures which are used in large areas such as the Amazon Basin, or in populated areas such as the Tennessee Valley, or in established

communities which have worked their lands for hundreds of years and have developed sophisticated social structures, are not necessarily suited to the Chapare, or to any other area. Each area is unique. What we have tried to do in this case is to weigh carefully the special characteristics of the area, the activities of the various agencies and institutions which already have made a substantial contribution to development in the area, the potential for future development, the strength of the committment to the region, and the possibilities for future financial support.

Having done all this, no answer to the administrative problem which would be universally acceptable has emerged. The task thus becomes one of reviewing various promising alternatives and selecting the one which appears to give the best chance of delivering the substantial, sustained and long-term committment which the development of the Chapare requires. That there is general agreement that a systematic attack on the problems of the Chapare is desireble, is demonstrated by the large number of agencies and institutions working in the region, and the effort to coordinate their activities through various committees and seminars. These efforts, while admirable, have not been adequate to bring about the desired result. The time is ripe for a new, more carefully planned approach.

C. ALTERNATIVE ORGANIZATION MODELS

"Integrated development" does not necessarily require the establishment of special machinery, within or outside the target area.

Integration can be planned and implemented from existing levels in the administrative heirachy.

Special planning and implementing machinery established in the target area itself, however, has the advantage of being able to operate with first-hand information and short lines of communication.

It has the disadvantage of disrupting established lines of authority, altering the bureaucratic pecking order, and threatening the power of some officials.

The choice between a program which depends entirely on established lines of authority and one which injects a new level of authority into the administrative structure involves a trade-off. Whatever choice is made, there will be some losses as well as gains.

One possibility would be to lodge the integrating role in the AID Mission itself. The mission could work out a series of projects (for example, roads, research and extension, potable water, and the provision of credit), each time-and spacephased to produce integrated development in the designated region. Loans or grants would then be made to the agencies regularly operating in the region, with the mission monitoring performance.

Another alternative would be to ask the Ministry of Planning to produce an integrated time-phased plan for the region specified. Outside financing, from AID and elsewhere, could be made available to the Ministry, which would be held accountable for results. The Ministry would presumably use the services of established implementing agencies, and it might open a branch office in the designated region to monitor progress and resolve local problems.

Another alternative would be to set up a virtually autonomous agency at the national level, as was done with the TVA. The TVA was eminently successful in raising funds and marshalling popular support. In effect, it was superimposed on the existing administrative structure and simply overrode it. The TVA experience, however, is almost unique. Its success depended on a confluence of circumstances and political support which has rarely been duplicated elsewhere.

Integrated planning can also take place at administrative levels below the national government, in departments or provinces. If this is attempted, the local administrative machinery usually has to be buttressed with additional funds and specialized personnel, since most of the planning talent available tends to gravitate to the national level.

Or a special administrative unit can be established in the region itself to undertake the effort. Such a unit might be independent of the normal administrative structure, or it might have ties to one or more ministries, or departments, or to the office of the President. Its geographical scope need not be coterminous with established administrative boundaries, and its functional coverage can be broad or limited to a few specific sectors. Whether or not such a unit can function successfully is partly a question of constitutional law, partly of personalities, and partly of the strength of the established bureaucracies. Public support flows in the direction of those who are able to add to the economic and social well being of their constituents, and if the established bureaucracies were already doing this successfully, an additional unit would be superfluous. 1/

D. ALTERNATIVES FOR THE CHAPARE

In the situation here under review, considerable preliminary research and planning on the Chapare and execution of pilot projects has already been done by PRODES, a semi- autonomous agency created two years ago for that purpose, among other things. 2/ The satisfactory results of that effort, the precedent already established, and the concensus that development efforts in the Chapare should be accelerated, have led to the conclusion that, if the

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1/ The attitude of the campesinos towards the deficiencies in public services and infrastructure in the Chapare were documented in Estudio de Necesidades Sentidas, PRODES, 1979. These deficiencies were further explored in the Conclusions y Recomendaciones del Primer Seminario Sobre el Desarrollo Integral del Chapare, Villa Tunari, 4 - 7 Octubre, 1978.

2/ PRODES was created in 1976 as a temporary agency, under the joint control of the Ministries of Agriculture and Interior, with responsabilities relating to coca substitution programs and studies in the Yungas de La Paz and the Chapare regions.

integrated development effort is to move beyond the information-gathering pilot project stage into a second phase of planning and investment for accelerated economic growth, a similar organizational arrangement would be desirable for the second phase.

Information-gathering is a necessary prerequisite to sound project planning and implementation, but the two processes are of different breeds. Projects involve money, and whenever money appears the tribal interests of the bureaucracy are aroused and the maneuvering for position gets underway. Whereas the gathering of information on the Chapare and the issuance of reports could be viewed as a relatively innocuous exercise, the potential to control large sums of money for development programs is not.

The new program being considered for the Chapare is different in kind from that pursued so far and threatens entrenched bureaucratic interests. The idea of administering it through a semi-autonomous successor to PRODES raises fundamental management problems, but we believe they can be resolved to the satisfaction of most of the interested parties if the pattern outlined below is followed.

In arriving at a proposed organizational pattern, we have rejected a number of attractive alternatives, primarily on pragmatic grounds.

The most obvious possibility of course, would be to use the TVA as a model.

We do not find this to be a realistic alternative, since the Chapare has neither the economic potential nor the political muscle required to make it a serious contender for special Presidential support in competition with the many other areas and sectors which are in need of attention.

Another obvious alternative is to place the program in CORDECO, which is the arm of the Ministry of Planning charged with planning and development in the

Department of which the Chapare is a part. By all logical standards, this would be the preferred organizational pattern. However, our inquiries revealed an almost universal reluctance to place additional burdens on CORDECO. The concensus was that it would be some time before CORDECO had the experience and staff to take on additional responsibilities. In our outlines below, however, it will be seen that CORDECO plays a major role in the proposed structure.

E. CRITERIA ON WHICH ORGANIZATIONAL PREFERENCE IS BASED

In selecting our preferred alternative from among the many choices available, several criteria were considered.

First, we wanted the planning, coordinating and implementing authority to be as close as possible to the scene of the action. Rapid action is not possible when decisions, or possible compromises between conflicting interests, must be relayed through several levels of authority before they can be addressed. In addition, officials remote from the scene frequently have difficulty in obtaining the information on the basis of which sound judgements can be made. This criteria was decisive in our decision not to place primary responsibility for the program in any La Paz-based agency or Ministry.

The second important criterion was to upset as little as possible the jurisdiction of existing agencies while recognizing that a new organizational unit was needed to do the job which was not being done at present. Any proposed organizational change is bound to affect some officials adversely. It is particularly awkward if such organizational changes appear to have been urged by foreigners. Therefore, we tried to minimize whatever threat to established bureaucratic prerogatives might be involved in the program, without sacrificing essential goals. For example, the new unit will be staffed in part by personnel drawn from the implementing agencies, which will themselves be made responsible for project execution.

A third criterion was to try to maintain the momentum which has already been developed, and from which the Chapare has been benefiting. We were told that a total of fifty agencies and institutions, public and private, are active in the region. All of these are doing valuable work, but some of them stand out prominently for their committment to the region, and for their willingness to devote attention, time and funds to its problems. Our recommendations are framed in such a way as to capitalize on this past show of interest and maintain the momentum already achieved.

A fourth criterion was to try to capitalize on the fact that even after the new Chapare/SantaCruz road is completed, the economic benefits from the development of the Chapare will accrue primarily to the Department of Cochabamba. At present only Cochabamba is connected to the area by highway, and it is the source for the region's inputs and the market for its products. While the development of the Chapare might have only a small effect nationally, its importance for the processors, suppliers, bankers and manufacturers of Cochabamba is already evident. Our recommendation is aimed at mobilizing this interest at the deparmental level.

A fifth criterion was to seek to capitalize on the expertise on the Chapare which already exists in many government agencies, and at the same time avoid the creation of an additional bureaucracy with a vested interest in the region, by utilizing personnel already available. The nucleus of a planning and research staff already exists in PRODES, and experts in various specialized fields can be found in other agencies. These should be made available, on a reimbursable basis, to the new agency.

A sixth criterion is the need to locate authority for the program as close as possible to those who will be held accountable for results. Since the economic potential of the area is almost exclusively agricultural, failure to develop the area will reflect adversely, first and foremost, on the agricultural authorities. Likewise, if development moves ahead rapidly, it is

the agricultural authorities who will deserve primary credit. While it may be that the bulk of the funds involved will go into public works such as roads, the roads are designed to serve agricultural producers, and the growth in economic product which they stimulate will be in the agricultural sector. If authority is to be commensurate with responsibility, the primary role in the program should go to the agricultural authorities.

F. SUGGESTED ORGANIZATIONAL RELATIONSHIPS

On the basis of the above criteria, our organizational preference is as follows:

1. To establish a new organizational entity called the Chapare Economic Development Authority. For administrative purposes, the unit would be attached to the Ministry of Agriculture, and its permanent (non-reimbursable) staff would be part of the Ministry of Agriculture career group.

   The head of the Authority would be appointed by the Minister of Agriculture and "refrendado" by the President.

2. The headquarters of the Chapare Economic Development Authority would be located in Villa Tunari, with liaison offices in Cochabamba and La Paz.

3. The Authority would be semi-autonomous. Its budget, as far as national funds were involved, would be a consolidated line item within the budget of the Ministry of Agriculture and would be supported by a detailed Authority budget document. This detailed document would include costs for all Control Council approved projects, including those related to roads, health and education investments,

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- Essentially, the relationship between the CEDA and MACA budgets should be the same as obtain between the budgets of the autonomous agencies and MACA.

as well as strictly agricultural items. The Director of the Authority would be delegated authority to approve expenditures in accordance with the approved budget. The Director would also be authorised to select his own permanent staff.

4. All funds, personnel and property of PRODES would be transferred to the Authority, except those located in or committed to the Yungas.[3/]

5. The Authority would be a planning, financing, servicing and monitoring agency. All project implementation would be carried out by existing line agencies on the basis of "convenios" (i.e. specific project agreements) signed with the Authority and monitored by the Authority, or via contracts with private firms.

6. The Authority would be responsible for both macro and micro planning in the Chapare. The first stage of the planning process would be to prepare a comprehensive five-year plan covering all sectors and setting time-phased quantitative goals for such things as production, exports from the area, road improvements, literacy rates, etc. The second stage would be a series of specific time-phased projects designed to achieve the goals of the five year plan, with full details as to inputs, expected outputs, and the organizational arrangements required. These projects would become the subject of individual project convenios signed with the implementing agencies. The third stage would be annual budgets with detailed expenditure figures by project. The present report is intended to supply the basis for such planning, and to provide parameters within which future programs and projects may be developed.

3/ It is assumed that PRODES - type activities will continue in the Yungas, even if a new Authority is established for the Chapare.

7. The staff of the Authority would consist of a nucleus of generalist planners, economic researchers, and administrative personnel, augmented by technical specialists secunded by the line agencies. The latter group would remain on the payrolls of their parent agencies, and the cost of their salaries would be reimbursed by the Authority. Any salary topping off and/or special allowances would be paid directly by the Authority to the individual. The line agencies would be under some obligation to supply specialized personnel to the Authority, but the Director would retain a veto right over personnel nominations.

8. The five year plan, all project plans, and the annual budget prepared by the Authority would be subject to review and approval by a Control Council established simultaneously with the establishment of the Authority. 4/ The chairman of the Control Council would be the Director of CORDECO. Ex-officio members would include the departmental representatives of the Ministries of Agriculture, Health and Education, and the Servicio Nacional de Caminos. The head of the Federation of Syndicatos would also be a member. Other entities which have an important role to play in the development of the Chapare, e. g. the Agricultural Bank, FENACRE, ELFEC, might be considered as either additional ex office members or be invited to participate in Council meetings on ad-hoc basis. The Director of the Authority would serve as Executive Secretary of the Control Council, which would meet at specified times to review Authority business. The development plan prepared for the Chapare would become an integral part of the plan for the Department of Cochabamba. Through CORDECO channels, it would be forwarded to La Paz for inclusion in the national plan.

4/ There already exist an Inter-institutional Committee which has been concerned with coordination in the Chapare. While its functions are different from those of the proposed Control Council, its work might be merged into that of the Council.

9. All development funds[5/] scheduled for expenditure in the Chapare would be controlled by the Authority. The Authority would be authorized to release funds in accordance with approved budgets and plans. Routine administrative expenses (such as teachers' salaries) would be handled in the normal manner.

Some development projects in the Chapare will presumably continue to be financed from funds available to the established agencies from the national or departmental budgets. These funds would be released to the implementing agencies only with the approval of the Authority, which would insure that they were intended for use on projects or programs approved by the Control Council.

10. Outside funding would reach the Authority after the normal procedures of the Bolivian Government had been satisfied. It would be highly desirable if the Authority were authorized to accept donations of services, equipment and funds directly.

Insofar as administrative/financial arrangements between AID and the Authority are concerned it is suggested that: (a) AID shift from a pre-audit (as is the case with PRODES) to a post audit procedure; (b) a procedure be instituted for the Authority to submit to USAID a quarterly "obligational" budget in advance of each trimester;[6/] (c) approval of the obligational budget will constitute authorization for the Authority to proceed with procurement

5/ "Development Funds" are defined as funds from foreign sources or the national or departmental budgets intended to finance new construction or the improvement of existing physical facilities, or to provide new services to the population or up-grade existing services. They do not include the regular and routine costs of services where no change in the service is planned, e. g. schools, health posts, hospitals, forestry stations, post offices, etc., or projects built with voluntary labor or local financing.

6/ Forms and detailed instructions for this type of budget and related documents can be obtained from USAID/Honduras where this procedure is in use.

of goods and services specified in the approved obligational budget up to a pre-determined amount and in accordance with pre-established written criteria; and (d) the Authority will proceed to undertake the approved procurement actions and then submit via the appropriate GOB channels the necessary documentation to support a claim for reimbursement and/or charge-off against an advance.

11. Development projects would be launched and their financing supplied on the basis of written agreements between the Authority and the implementing agencies or contractors. These would describe the work to be accomplished, the time in which it was to be accomplished, the facilities, personnel, equipment and funds (if any) to be supplied by the implementing agencies, and the funds, equipment and other support to be supplied by the Authority when outside funds for which it was accountable were involved. Such agreements would be pursuant to projects and plans already approved by the Contro Council. The Authority would be responsible for monitoring performance to insure that the actions of the implementing agency were in accordance with the agreements.

G. FUNCTIONS OF THE AGENCIES

Under this proposed organizational pattern, the functions of the interrelated agencies would be as follows:

1. The Ministry of Agriculture

a) Nominates the Director of the Chapare Economic Development Authority, who is endorsed by the President and confirmed by Congress.

b) Provides a planning and administrative staff nucleus for the Authority as well as providing technical personnel on a

reimbursable basis from its own subsidiary agencies and field staff.

c) Includes the operational requirements of the Authority for national funds as an integral part of its own budget submission to the budgetary authorities.

d) Implements, through its subsidiary agencies and field staff, approved projects in accordance with written agreements with the Authority.

2. Other Ministries

a) Provide specialized personnel to the Authority on a reimbursable basis.

b) Authorize their Cochabamba representatives to serve on the Control Council to review Authority plans and projects.

c) Implement approved projects in accordance with written agreements with the Authority.

3. Chapare Economic Development Authority

a) Prepares a comprehensive rolling five-year development plan for the region which includes quantitative, verifiable goals and which is revised annually.

b) Prepares, in cooperation with the established agencies, specific project plans designed to achieve those goals.

c) Prepares annual budgetary proposals and submits them, after Control Council approval, to the budgetary authorities via Ministry of Agriculture channels for inclusion in the national budget.

d) Receives funds from the national budget and from outside sources to finance approved plans.

e) Executes agreements with implementing agencies to undertake approved projects. Such agreements should include a) a description of the work to be accomplished; b) a time limit within which it is to be accomplished and c) a description of the inputs (equipment, personnel, space, funds, etc.) expected from the Authority on the one hand and the implementing agency on the other.

f) Procures the equipment and supplies for approved projects.

g) Promotes private and international agency interest in the economic development of the region and aggressively seeks financing for projects which will contribute to such development. In this connection, the Authority undertakes and/or commissions pre-feasability and other types of studies.

4. The Control Council

a) Reviews and approves all plans, projects and budgets of the Authority.

b) Authorizes the submission of plans for the Chapare to CORDECO for inclusion in Departmental and National plans.

c) Provides the principal point for coordination among the agencies working in the Chapare.

H. ORGANIZATIONAL PATTERN FOR THE AUTHORITY

The Chapare Economic Development Authority will have the advantage of starting its work with the knowledge and expertise already developed in PRODES. However, the role of the new agency will be considerably broader than that of PRODES, particularly in two aspects; first, it will need to have the capacity to do both macro and micro-economic planning, and second, it will need to be able to prepare and monitor projects in a variety of specialized areas. This will inevitably require the addition to the staff of specialized personnel not now available in PRODES.

Although the organizational configuration of the Authority should be a prerogative of the Director, for planning and illustrative purposes an organizational chart is attached. Projected administrative costs for the organization, during its first five years, have been computed from this illustrative organization.

The planning staff is assumed to consist of three people, and its head would act as Director in the absence of the Director himself. These three staff members should all hold advanced economic degrees, and at least one should be an agricultural economist.

The research staff should also have a permanent cadre of three. It would be their responsibility to design economic research projects intended to improve the data base on which planning would proceed. These could then be contracted out or executed by people hired for short-term assignments.

The administrative staff will be responsible for personnel work. administrative budgeting, accounting, and procurement. The personnel work will be somewhat different from normal personnel activities, since arrangements will have to be made for details of personnel from a number of other agencies. At least one individual should specialize in procurement. He should understand AID's procurement regulations as well as be experienced in local markets. It might be desirable to locate him in Cochabamba. A

total of seven technicians will be needed for the administrative unit.

While the whole Authority will be oriented around the idea of accelerating the rate of development in the Chapare, a special effort should be made to attract new business ventures to the region. The first priority would be to help establish the vertically integrated corporations which are suggested elsewhere in this report for tea, cacao and rubber. In addition, the Authority should be prepared to help businessman assess potential enterprises such as farm supply businesses, and get new projects underway. It should also promote the area and "sell" businessman on the idea of establishing activities there. While the function of agri-business development will probably not involve any Authority funding, one full-time staff member should be assigend to it, assisted by a foreign advisor.

The proposed organizational arrangement requires a large number of interagency agreements to be executed. To insure these are in proper form, a lawyer should be retained on an as-needed basis.

A communications media staff will be needed to serve the public relations function of the Authority. This staff will prepare programs for a local radio relay station, and be responsible for publications issued as farmer information bulletins. Since its facilities will be available to the entire organization and to all sectoral agencies operating projects under convenios, it should be set up as a staff agency. Its specific functions and costs are detailed in Chapter V, Section E, of this report.

The functional work of the Authority will fall into three major areas: Transportation, Agriculture, and Public Services such as health care, education, rural electrification, potable water, and urban planning.

Consideration has been given to the idea of limiting the functional coverage of the Authority to only those areas which are expected to receive outside

financing. This has been rejected in favor of a fully integrated effort which will involve all of the agencies which are essential to a balanced development program. Thus the Authority will have to be given jurisdiction over development activities for which it may or may not be able to arrange special financing, such as in the education sector.

If the agencies providing these services were excluded from the integrated program, the chances of getting special financing for their programs would be minimal. If they are part of the effort, the possibility of arranging such financing at a future date is considerably enhanced.

Personnel for the functional units, including agriculture, should be provided by existing agencies on a reimbursable basis. The Director could either request people he wanted, or he could accept or reject those nominated. In any case, the existing agencies should understand their obligation to supply acceptable staff to the Authority. Those accepted should not only have technical expertise but should be capable also of assessing needs, preparing plans, designing projects and monitoring performance. They would need to have somewhat broader interests than the typical technician.

In order to reduce the span of control, we have placed the functional specialists for those areas in which the Authority will not have arranged special financing in a single group, called Public Services. As the program evolves, and if special financing is arranged for any of these areas, a different organizational arrangement may be needed. As it stands, the head of this unit should be a man who is able to rise above his technical specialty and deal with a broad spectrum of problems. We believe people can be found who would welcome such an opportunity to broaden their area of operation.

The <u>transportation</u> unit should have two people over the entire life of the program. When project loads become heavy in these specialized sectors,

additional personnel can be obtained from the parent agencies on temporary detail. And as the number of projects in operation multiplies, it may be necessary to add personnel whose principal function is one of monitoring progress.

The heavy emphasis on agriculture in the Chapare will require more people in that sector than in the others. At least one person is needed to watch the flow of credit; one will be needed to follow the progress of land titling, to stimulate activity in the concessions, to act as liaison with the national park authorities, and to keep in touch with developments in the forestry sector. 7/

A specialist in community organization could help the Authority capitalize on the already high level of community participation in development activities and perhaps stimulate even greater activity through the formation of additional producer and consumer organizations.

The problems of marketing in the Chapare have received little attention so far, and some catching up is needed. One man should be made available for this effort. As production expands and new crops come on the market it is possible that one more might be needed, but we are not now assuming that this will be the case.

Preliminary plans involve a considerable expansion in research and extension activities in the Chapare on the part of IBTA. To plan for this expansion and to monitor results, two technicians should be made available. Obviously, the person who is selected as the overall head of this considerable effort in the agricultural sector should have broad experience in tropical agriculture.

7/ Should projects involving any of these activities be developed in future years, it would be necessary to strengthen this unit.

The risk involved in using personnel secunded from the existing agencies is that their loyalties will be divided. The Director will wish to insure that people made available to him have as their primary interest the rapid economic development of the Chapare, and not the protection of some real or imagined bureaucratic flank. Such interests should be fully protected by the requirement that all projects, plans and budgets be reviewed and approved by the Control Council. The Control Council will mainly deal with the Director, who will act as its Executive Secretary, and with the head of the planning unit, who will be presenting the results of his work. However, the Council will probably wish to probe into some projects, and technicians should be prepared to appear before the Council to explain and defend their projects.

The Authority will also need ancillary services, principally clerical and secretarial services, transportation and office space. 8/

If the Authority is located in Villa Tunari, as suggested, new office facilities will be required. There is at present no space which could be made suitable. Land is plentiful, however, and planning should begin at once on new office facilities. 9/ A feasibility study should be undertaken to determine the most appropriate type of construction, its location and probable cost. The same study should cover the availability of bachelor quarters and family housing for employees. It might also inquire into the need for expanded educational and medical facilities to accomodate personnel of the Authority.

Based on the above estimates of personnel and other requirements, a five-year projection of administrative costs, together with supporting data, is presented at the end of this chapter.

8/ Emergency housing and emergency motor vehicle maintenance facilities may also be required in the preliminary stage. However, the Authority should not allow itself to be drawn into the hotel or garage business. The private sector should be encouraged to respond to these demands.

9/ In view of the absence of office facilities, one possibility would be to activate the Authority in two stages. The first stage, say six months, could be devoted entirely to macro-planning, while facilities were being prepared to accomodate the staff required for project design and monitoring.

I. FOREIGN ADVISORS

The number of foreign advisors attached to the Authority should be kept at a minimum in order not to diminish its national character. We recommend only one long-term advisor, two advisors for 2 years each, and one man-year of short-term advisors per year.

For the first two years of operation, it would be desirable to attach a Regional Development Specialist to the Office of the Director. He would assist in getting the Authority launched and pointed in the right direction, help develop procedures which would facilitate effective management control, help work out systems for project design, financing, procurement and monitoring in cooperation with the implementing agencies, and provide advice and counsel on the planning function and on the design of studies to be contracted.

An Agri-business Development Specialist should also be provided for the first two years. He would be expected to train a Bolivian counterpart in the art of attracting private capital to the Chapare for investment in enterprises related to the project but not necessarily a part of it. He would be a promoter, performing the same function as do officials of regional, state and municipal development councils in the United States. Since a Bolivian familiar with this function is not likely to the found, an in-house training program is desirable.

One foreign advisor to the Authority will be needed for the entire life of the project, to serve as Supervisory Highway Construction Engineer. The Authority is expected to be heavily involved in road improvement and the procurement of highway equipment. The foreign advisor should not only be familiar with construction equipment, but should also have a through understanding of design standards and their variations.

Since we are unable to anticipate at this time all the problems in which foreign advisors might be useful, we have left some flexibility in the area of short-term advisors. The Authority should be able to call on about one-man year of such services per year for the life of the project.

J. STEPS REQUIRED TO ESTABLISH ENTITY

In order to make the Chapare Economic Development Authority a functioning entity, a Presidential Decree approved by Congress is required. All such legal steps should be completed before disbursements are made from any outside funds made available to the Authority.

The Presidential decree should:

1. Establish the Chapare Economic Development Authority as a semi-autonomous juridical personality within the administrative structure of the Ministry of Agriculture.

2. Transfer to the Authority all funds, personnel, files and property of PRODES, except those located in or committed to the Yungas.

3. Authorize the Minister of Agriculture to nominate a Director for the Authority, subject to Presidential approval and Congressional confirmation.

4. Authorize the Authority to spend funds previously available to PRODES, to seek funds from the national budget through Ministry of Agriculture channels, to accept donations of goods, services or funds from abroad, and to apply for foreign loans through established channels.

5. Authorize the Authority to establish offices as needed, organize

to results achieved.

11. Require the Authority to publish an annual report on its activities.

12. Require that, two years after the Authority is activated, its operations be subjected to an evaluation by representatives of the Ministries of Planning, Agriculture, Health, Education, the Servicio Nacional de Caminos, and the Federación Tropical de Sindicatos.

The decree should not refer to coca. Any such linkage is bound to diminish the effectiveness of the Authority as a development agency, for the producers with whom the Authority must work will suspect that its programs are being pressed not to improve their level of living but to reduce coca production. Persuading farmers to abandon established patterns and introduce new cultural practice and new crops is a difficult business under the best of circumstances; the difficulty is compounded if farmers suspect from the outset the motives of those attempting to bring about such changes.

The decree should avoid specificity in such questions as organizational detail. It should contain general grants of authority and general restrictions. Organizations should be dynamic, not static. Any language which might tend to restrict the Authority in evolving to meet the needs of the Chapare as they emerge and are identified, should be avoided.

Perhaps in its preamble, the decree should recognize the need for continued data collection and analysis. Nothing would discredit the Authority more quickly than to have some of its early efforts go sour because they were based on faulty statistics or hasty analysis. From the evidence at hand, it appears that a great deal remains to be done before reliable and complete data about the Chapare is available to planners.

K. RULES OF OPERATION FOR THE AUTHORITY

Bolivian governmental entities are expected to draw up for Presidential approval their "statutes", which spell out the rules under which they will operate.

For PRODES, the "statutes" cover fourteen single-spaced typewritten pages, covering forty eight "articles" grouped into four "titles" and fifteen "chapters".

The PRODES statutes cover the juridical nature of the organization, its location, its acronym, its life span, its objectives, functions and organization plan; the composition of its board of directors and the board's functions and prerogatives; the duties of the director of PRODES, the qualifications needed for the job and the procedure for his removal; the composition and functions of the technical committee; the functions of each of the organizational units within PRODES; the functions of the decentralized offices, etc., etc.

The statutes of the new Authority will be substantially different from those of PRODES, since the two organizations are quite dissimilar in their methods of operation. The major operational tool of the Authority will be the project agreement, or convenio, which it prepares to cover each development project being undertaken in the Chapare and negotiates and signs with one of the implementing agencies. The statutes should describe in detail the use of this operational tool.

The project agreement can be considered as the fulcrum of the Authority's functions. Before such an agreement can be signed, the Authority must get its long-term plan in order, perhaps do some micro-planning, design a project, insure that the implementing agency is on board, line up its inputs, and get Control Council approval. After the agreement is signed, the Authority must insure that its provisions are being carried out, deliver its share

of the inputs, resolve problems that arise during implementation and perhaps amend the agreement to correct unanticipated difficulties.

By spelling out the mechanics of the project agreement system, how the agreement comes into being, what the responsibilities of each party to the agreement are, and what happens if those responsibilities are not met, almost every function of the Authority will be covered.

The statutes should, insofar as possible, avoid such details as position and organizational titles, or the functions of particular organizational units. These change over time, and the statutes should not inhibit such changes. Rather, the statutes should be concerned with procedure - financial, administrative, personnel, planning, procurement, implementation, evaluation. Although some references to organizational units or position will be unavoidable in describing the procedures which the Authority uses, such references should be kept as general as possible while still making certain that the procedure is clearly understand.

The final draft of the statutes will probably require the services of a lawyer, to insure that all points required to be covered are covered in fact. They will also require consultation with the implementing agencies and the financial authorities to remove ambiguities in language and to insure that the proposed procedures are understood and accepted. Even so, it is unlikely that all possible variations and contingencies could be anticipated, and a means of amending the statutes as adopted should be provide. The original statutes might provide, for example, that they could be amended by action of the Control Council. Otherwise, either the statutes themselves tend to become outdated and increasingly ignored, or the Authority becomes locked into a rigid position which limits its effectiveness.

L. LIFE-SPAN AND FUNCTIONAL JURISDICTION

There remain two questions. The first is whether the Authority should be considered as a determinate agency with a limited life-span (say five years, the life of the proposed AID project), or whether it should be considered a "permanent" part of the administrative machinery. In the long run, this distinction may not be important, since the Bolivian government can abolish any agency it wishes at any time. In the short run, however, the distinction may make a difference.

If quantifiable goals could be established now and the Authority given a limited time within which to achieve those goals, the result might be a more intense effort on the part of those responsible. At this point, however, not enough is known about the potential of the Chapare to establish anything but general goals. It is hoped that quantifiable goals will emerge as the Authority prepares its five year plan, but the survey team would be reluctant to be specific as to economic potential on the basis of its present knowledge.

While it is possible that placing a time limit on the Authority might stimulate it to greater action even if its goals were general, the more likely outcome is that such a limitation would cripple the Authority in its relations with other agencies. A "temporary" agency is at a disadvantage in negotiating with established agencies whose life-span is indeterminate. It may be out of business before certain issues have to be faced; its personnel may be angling for jobs in the "permanent" agencies before their own jobs are abolished and therefore may have a conflict of interest. In any case, it is likely to be difficult to recruit and retain high-quality staff for a temporary agency.

We therefore believe that the life span of the Authority should not be limited at the beginning. There will be occasions in the future when phasing

out the Authority or merging it with other agencies could be considered.

The second question is whether the Authority should be limited to those sectors in which there is the possibility of early outside financing, e. g. agriculture and roads, or whether it should take on the job of planning the entire range of social and economic activities which contribute to the development process.

Aside from the practical consideration that, if the Authority proves to be an effective instrument, it will tend to attract financing for any sector in which it is active, there is the further consideration, repeatedly demonstrated in developing countries around the world, that economic progress is a seamless web in which each strand is interwoven with every other.

Agricultural producers have difficulty with modern herbicides if they are unable to read the instructions for their use, and children do not go to school if their families are so poor as to be unable to buy proper clothes for them. Farmers are reluctant to settle in disease-ridden areas. Food processing plants are viable only if there are assured supplies of raw materials, and the supply will be produced only if there is a market for it. If a road is to be improved, the health and education authorities should know about it well in advance so they may prepare to provide services to the settlers which will inevitably follow. Electricity should also follow the roads, and potable water should follow the electricity.

The obvious interrelationships among the various elements of the development process have often been ignored, and the result has been the misuse or waste of resources, or a failure to satisfy basic needs. Nothing will more quickly discredit a development plan than to build a school which stands empty for lack of students, or to encourage farmers to grow a product for which there is no market.

Comprehensive planning brings a sense of discipline to the development process;

it helps to avoid excesses and gaps; it defines the alternatives available; it forces decision makers to set priorities and time schedules; it makes clear the need for careful choices as to where and for what limited resources will be used. Such planning is a prerequisite to integrated development, and integrated development cannot occur if major social and economic activities are excluded from the plan. We believe that any other course than to include all elements would be inconsistent with the intent of this study.

itself and employ personnel.

6. Authorize the Authority to control all funds available for social and economic development projects in the Chaparé. The disbursement of foreign funds would be authorized by the Authority directly pursuant to approved programs and projects, while national funds would be disbursed by the Ministry of Finance only with Authority approval. 10/

7. Authorize the Authority to prepare a five year plan for the Chaparé, including quantitative goals, specific projects designed to achieve those goals, and annual expenditure programs to support the projects.

8. Authorize the establishment of a Control Council to review and approve all plans, projects and budgets proposed by the Authority. The Council would meet at regular intervals at the headquarters of the Authority. Its chairman would be the President of CORDECO. Members would be the departmental representatives of the Ministries of Health, Agriculture and Education, the Servicio Nacional de Caminos, the head of the Federación Tropical de Sindicatos, and any others deemed necessary by the GOB.

9. Authorize the Authority to utilize on a reimbursable basis the services of technical personnel seconded by the established agencies and make it incumbent upon those agencies to supply such personnel.

10. Authorize the Authority to negotiate agreements with other agencies at the national, departmental or provincial level to undertake the execution of approved projects on behalf of the Authority, to tranfer funds to such agencies, and to require reports from them as

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10/ If the necessary arrangements can be made, it would be desirable to have both foreign and national funds deposited by the Ministry of Finance in the DCCP. Funds would then be made available to the Authority automatically on a quarterly basis in accordance with a pre-determined schedule.

ILLUSTRATIVE ORGANIZATION

CHAPARE ECONOMIC DEVELOPMENT AUTHORITY

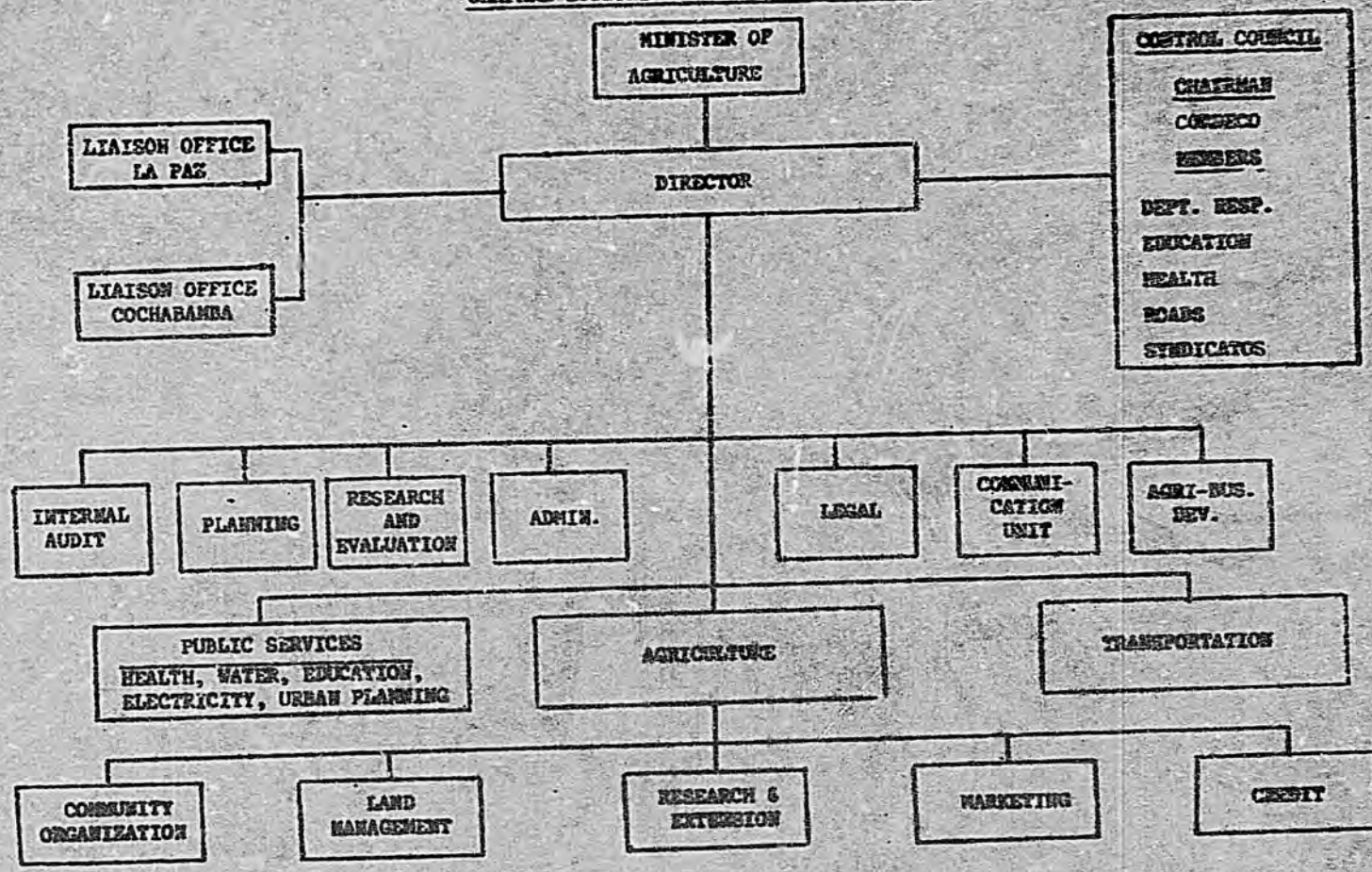


TABLE IV-1

Projections of Administrative Expenses
US$

OBJECT	YEAR ONE	TWO	THREE	FOUR	FIVE
1. Salaries 1/	236,340	350,906	441,754	435,938	534,526
Technical & Professional	181,350	269,280	341,402	375,542	413,089
Secretarial	30,420	43,758	53,797	59,181	65,097
Other	24,570	37,868	46,555	51,215	56,330
2. Travel 2/	2,275	3,366	4,023	4,422	4,855
3. Procurement	98,760	54,369	78,986	4,655	5,210
Vehicles 3/	73,700	50,409	74,751	-	-
Office equipment 4/	21,560	-	-	-	-
Office supplies 5/	3,500	3,960	4,235	4,655	5,210
4. Utilities	5,664	6,376	6,933	7,582	8,372
Electricity 6/	3,720	4,224	4,599	5,040	5,544
Telephone 7/	1,200	1,320	1,452	1,597	1,757
Water 8/	744	832	882	945	1,071
5. Office Space	213,810	6,062	6,668	7,335	8,066
Rent 9/	3,600	3,960	4,356	4,792	5,271
Construction 10/	210,210	-	-	-	-
Maintenance 11/	-	2,102	2,312	2,543	2,797
6. Vehicle fuel and maintenance 12/	90,651	108,489	119,340	131,274	144,400
7. Foreign Advisors 13/	360,000	396,000	217,800	239,580	263,538
8. Impact Project Fund 14/	10,000	10,000	10,000	10,000	10,000
9. Contract Services for Feasibility and other studies 15/	100,000	110,000	121,000	133,000	146,000
TOTALS ...	1,117,500	1,045,568	1,007,525	1,023,786	1,124,869
FIVE YEAR TOTAL ... $.	5,319,248				

NOTES TO TABLE IV-1

1/ Average salaries for year one are assumed to be as follows:

Professional and technicial personnel, $. 750 per month; secretarial personnel, $. 300 per month; other personnel, $. 225 per month, all in US$. dollars. For each year beginning in year two, a 10% inflation factor is added.

Lapse rates are assumed to be as follows: year one, 35%, year two, 15%, years three, four and five, 5%.

These figures include salary plus all allowances, including per diem, housing, education, social security, retirement, etc. with no exceptions. It also includes a $. 150 per month separation allowance for married professional personnel, whose families do not live in the Chaparo.

2/ Computed at $. 100 per year for each technical and professional employee, including foreign advisors, with a 10% inflation factor added beginning in year two, and applying the same lapse rates as above.

3/ End-of-1979 price estimated as follows: sedan $. 8,000; pick-up truck $. 12,660; carryall, $. 14,500; bus $. 30,000. Procurement assumed to take place in 1981 and thereafter with prices rising at rate of 10% per year after 1980.

4/ $. 19,600 at current (end-of-1979) prices. Ten percent has been added on assumption procurement will not take place before 1981. Equipment for the Communications Media unit will be financed from the Communications project. Some equipment procurement could be deferred until year two if staffing is not completed in year one.

5/ Estimated at $. 100 per technical and professional employee per year, including foreign advisors, with a 10% inflation factor beginning in year two.

6/ Computed at $. 5 per month per employee, including foreign advisors, with 10% inflation factor added beginning in year two.

7/ Computed at $. 100 per month total for Cochabamba and La Paz, with a 10% inflation factor beginning in year two. Villa Tunari will use radio communication, with an in-house telephone network.

8/ Assumes that a municipal system will be installed in Villa Tunari. Computed at a $. 1 per employee per month, with 10% added each year beginning in year two.

9/ Only in La Paz and Cochabamba. Computed at $. 2 per square meter per month in Cochabamba and $. 4 per square meter per month in La Paz, with 10% added each year, beginning in year two.

10/ Computed at estimated Cochabamba cost at end-1979 ($ 200 per square meter) plus 30% for added costs in Villa Tunari. Assumes construction will be completed by end of 1981. Ten percent inflation factor is added to end-1979 prices, for a total of $ 286 per square meter. Final cost will vary depending on design selected.

11/ Maintenance computed at 1% per year of original cost, with 10% inflation factor beginning in year two.

12/ Computed at 50% per year of current cost of vehicle.

13/ Computed at $. 90,000 each with 10% added beginning in year two. Short term advisors computed as equivalent to one long-term advisor.

14/ To be used at the Director's discretion.

15/ Ten percent added per year beginning in year two.

TABLE IV-3

Non - Technical Staff

CATEGORY	YEAR				
	ONE	TWO	THREE	FOUR	FIVE
Secretaries 1/	13	13	13	13	13
Drivers 2/	10	11	11	11	11
Guards/Messengers 3/	4	4	4	4	4
TOTAL	27	28	28	28	28

1/ Based on one secretary for three professionals, including foreign advisors, plus one for Director.

2/ Based on one vehicle for four professionals, including foreign advisors, plus one for Director.

3/ Two in Villa Tunari, one each in La Paz and Cochabamba.

TABLE IV-4

Foreign Advisors 1/

POSITION TITLE	YEAR ONE	YEAR TWO	YEAR THREE	YEAR FOUR	YEAR FIVE
Regional Development Spec.	1	1	-	-	-
Agri-business Development Spec.	1	1	-	-	-
Supervisory Highway Constr. Eng.	1	1	1	1	1
Various Short Terms Advisors	One Man-year	One Man-year	One Man-year	One Man-year	One Man-year

1/ Foreign advisors are estimated to cost $. 90,000 per year each in 1981. Same figure is used to cover annual cost of short term advisors.

TABLE IV-5

Office Equipment Requirements 1/

ITEM	PRODES 2/ INVENTORY	NEEDED BY AUTHORITY	TO BE 3/ PURCHASED	UNIT 4/ PRICE US$	TOTAL COST 5/ US$
Exec. Desk (7 drawers)	23	36	13	250.00	3,250.00
Sec. Desk	12	13	1	200.00	200.00
Typewriter, mannual	3	0	0	-	-
Typewriter, elect.	6	13	7	1,100.00	7,700.00
File cabinets	14	18	4	200.00	800.00
Exec. Chairs	15	36	21	150.00	3,150.00
Conf. Table	3	1	0	-	-
Sec. Chairs	12	13	1	100.00	100.00
Misc. Chairs	75	52	0	-	-
Furnishings for Director	3	1	0	-	-
Typewriter tables	13	13	0	-	-
Library shelves	-	300 ft.	300 ft.	125.00	125.00
Desk lights	-	20	20	50.00	1,000.00
Book cases	28	18	0	-	-
Map cases	-	1	1	100.00	100.00
Duplicating machines	2	3	1	1,750.00	1,750.00
Telephone Central	1	1	1 6/	900.00	900.00
Calculators	3	18	15	35.00	525.00
Misc. Tables	20	20	0	-	-
				TOTAL	US$ 19,600.00

1/ Equipment for the Communications Media unit is listed in the Communications Project.

2/ As of Dec. 30, 1978. Not including items in the Yungas liaison office.

3/ Inventory should be updated before purchases are made.

4/ End of 1979 estimates, in dollars.

5/ This assumes a reliable supply of electricity is available.

6/ Present telephone central unsuitable for Villa Tunari.

TABLE IV-6

Vehicle Requirements 1/

	AVAILABLE IN PRODES 2/	NEEDED BY AUTHORITY	YEAR OF PROCUREMENT				
			ONE	TWO	THREE	FOUR	FIVE
Sedan	0	1	1	-	-	-	-
Pick-up truck	3 3/	2	-	1	1	-	-
Carryall	5 4/	8 5/	2	2	3	-	-
Bus 6/	-	1	1	-	-	-	-

1/ Based on one vehicle for every four technical and professional employees, including foreign advisors. One carryall is needed for La Paz and one for Cochabamba. Sedan is reserved for Director.

2/ Does not include vehicles located in the Yungas or those transferred to University of Florida.

3/ Assumes 1973 model will not be replaced. 1977 model will be replaced in 1982 and 1978 model in 1983.

4/ Assumes 1973 model will be replaced in 1980, 1977 model in 1982, 1978 models (3) in 1983..

5/ Two new carryalls will be purchased in 1981 and one in 1982.

6/ To transport employees between Villa Tunari and Cochabamba.

TABLE IV-7

Office Space Requirements

LOCATION	SPACE PER EMPLOYEE	No. OF EMPLOYEES 1/	TOTAL REQUIRED
VILLA TUNARI	15 sq. meters	44 2/	735 sq. meters
LA PAZ	15 sq. meters	3	45 sq. meters
COCHABANBA	15 sq. meters	4	60 sq. meters

1/ Includes foreign advisors, excludes drivers and guards.

2/ Communications Media unit requires 75 sq. meters in addition to that required by administrative staff.

TABLE IV-8 IV-40

Unit Costs - Administrative Expenses 1/ 2/

ITEM	Y E A R				
	ONE 3/	TWO	THREE	FOUR	FIVE
Average annual prof. and tech. salary	9,000	9,900	10,890	11,979	13,177
Average annual secretarial salary	3,600	3,960	4,356	4,792	5,271
Average annual salary - others	2,700	2,970	3,267	3,594	3,953
Annual travel cost per prof. and tech. emp.	100	110	121	133	146
Sedan	8,800	9,680	10,648	11,713	12,884
Pick-up truck	13,976	15,319	16,851	18,536	20,389
Carryall	15,950	17,545	19,300	21,230	23,353
Bus	33,000	36,300	39,930	43,923	48,315
Executive desk	275				
Electric typewriter	1,210				
File cabinet	220				
Executive chair	165				
Desk light	55				
Calculator (hand)	38				
Electricity - per emp. p/year	60	66	73	80	88
Water - per emp. per year	12	13	14	15	17
Rent per sq. meter La Paz	24	26	29	32	35
Rent per sq. meter Cochabamba	48	53	58	64	70
Construction per sq. meter. Villa Tunari	286				

1/ In dollars.
2/ Assuming a 10% per year rate of inflation.
3/ Year one is assumed to be 1981. Prices for equipment and vehicles have been increased 10% above end-of-1979 estimates to adjust for inflation.

V. PROGRAM ACTIVITIES

A. Introduction

The preceding chapters of this report have been concerned primarily with a description and an analysis of the situation in the Chapare, with a broad treatment of the development strategy to be followed, and with a discussion and recommendations as to the institutional arrangements, i.e. an Area Development Authority, for administering the program. The costs of staffing and operating the Development Authority are dealt with in Chapter IV dealing with that entity. Also included there is a small sum of money US$ 10,000 annually, for impact projects, targets of opportunity and a somewhat larger sum, US$ 100,000 per year, for feasibility and other studies. Insofar as other program funds are concerned, we suggest that AID and GOB funds be allocated to the Area Development Authority by functional categories e.g. Research and Extension, Credit, Road Construction and Maintenance, etc. and that the Area Development Authority, subject to approval of its annual budgets, have considerable flexibility in the allocation of the funds within the region via specific project agreements for each functional category. The details on costs within each functional category are illustrative and intended only as a means of indicating how the total for each functional or program category was

arrived at. If this suggestion is accepted, the program activities described in the following chapters will be synonimous with the functional categories. There is, however, one exception to this rule.

For some of the new production lines recommended for active promotion and development in the Chapare, we believe that there may be advantages (principally efficiency) in having the Area Development Authority vigorously attempt to promote one or more vertically integrated, mixed private-public sector corporations to be responsible for the entire gamut of production (nurseries, establishment of plantation, agricultural inputs, technical assistance, producer credit), processing, and marketing functions. This is an alternative to dealing with the production function for these products as a component of the public sector Research and Extension Program Activity, processing as a component of the Agro-Industry Program Activity, and marketing as a component of the Marketing Program Activity. The products for which we recommend the vertically integrated corporation approach are: tea, cacao, and rubber.

In terms of organization of the material in the following chapters of the report we will first present the total requirements for each of the above products, one by one, under a vertically integrated corporation concept. We will suggest that a lump sum be allocated to the Area

Development Authority for this component of the program. Then we will describe the program content for each of the other product lines to be promoted under the proposed program. Finally, we will deal with each of the functional Program Activity components of the proposed program, excluding from them the requirements for the above listed new product lines. The data presented under each of the vertically integrated products lines is organized in a manner which permits it to be easily disaggregated and incorporated into the functional program activities if it is decided to follow the latter route, rather than the one recommended.

B. The Vertically Integrated Corporations

1. General Concepts and Considerations

The concept of vertically integrated corporations, the fixed assets of which are limited to the plant and equipment necessary for processing, but which provide to the individual producer under contract the entire range of inputs, including credit, and technical assistance necessary to obtain the desired and contracted for product, is not new. Most tobacco grown and processed in Latin America is produced in this fashion. In Bolivia, the milk products corporation, PIL, while state owned, is run on this basis.

TABLE IV-2

Technical and Professional Staff

OFFICE UNIT	YEAR ONE	TWO	THREE	FOUR	FIVE
Director's office	1	1	1	1	1
Planning	3	3	3	3	3
Research and Evaluation	3	3	3	3	3
Administration	7	7	8	8	8
Legal	1	1	1	1	1
Communications Media 1/	-	-	-	-	-
Agri-business Development	1	1	1	1	1
Public Services	2	3	4	4	4
Transportation	2	2	2	2	2
Chief, Agriculture	1	1	1	1	1
Community Organization	1	1	1	1	1
Land Management	1	1	1	1	1
Marketing	1	1	1	1	1
Credit	1	1	1	1	1
Research and Extension	2	2	2	2	2
La Paz	2	2	2	2	2
Cochabamba 2/	2	2	2	2	2
TOTAL	31	32	33	33	33

1/ This staff is financed and supplied from communications program funds.

2/ Plus one technician on detail from administrative unit to handle procurement.

If, as we believe desirable and feasable, the Corporation (s) in the Chapare should be initially mixed private/public sector enterprises -converting eventually to completely private sector ownership- they must be designed so as to protect the interests of the small farmer who produces the raw material. There are many formulae to this end, and the Area Development Authority, which will have the responsibility for promoting and organizing the Corporation(s) should be allowed considerable flexibility in negotiating suitable arrangements. One possible arrangement (which we are using as a model for calculating public sector funding requirements) is as follows:

a) The corporation is created with an equity participation of 40% by the Area Development Authority and 60% by private sector investors. (Whatever the ratio used the government should always be in a minority position).

b) The corporation's financial structure contemplates a 1 : 1 debt/equity ratio.

c) The Area Development Authority lends the Corporation an amount equal to 50% of its plant and equipment and operating capital requirements on terms of 10% interest annually, a suitable grace period on both principal and interest, and a suitable pay back period.

d) Five percent of the value of the farmer's sales of raw material to the corporation are paid to him in stock in the company, which is sold to him from the shares held by the Area Development Authority

at their original cost to the Authority. Thus, over a period of time the farmers, collectively, become a major shareholder in the enterprise.

The products we are dealing with here have a long production development period -from 3 to 7 years. This consideration leads to several further features for the purposed model, as follows:

a) If it is agreed -as we recommend- that the corporation(s) should be established at the initiation of the program, it will be responsible for three phases of the operation: the development of production phase, the construction phase, and the operational phase.

b) With regard to the production phase, we recommend that as a general rule only the management costs of the company, design work for the plant and any marketing studies be financed from the equity payments by shareholders and the loan from the Authority. The remainder of the production development costs (e.g. seed, nursery establishment, promotional and technical assistance personnel and their equipment requirements), which are provided by government services under more traditional arrangements, should be financed by the Area Development Authority. These funds, which will be provided periodically, as needed, by the Area Development Authority will be on a grant basis and will be monitored and audited by the Area Development Authority. These payments will show up on the Corporation's

books as paid-in surplus. Any capital items acquired with these funds will be titled in the company.

c) At the formation of the Corporation, i.e. the initiation of the production development phase, there will be only nominal capitalization (in amounts equal to anticipated management costs) with the stockholders having preemptive rights to acquire new issues of stock when the company is ready to initiate the construction phase. (Alternative arrangements such as token deposits and callable shares are also possible).

To illustrate how the above concepts would work in a simplified situation, let us assume that for a given product line, the production development costs, exclusive of management costs, are $ 100,000; and that the management, plant and equipment, and operating capital costs are also $ 100,000, or a total cost of $ 200,000 for the project.

The Area Development Authority would provide $ 170,000, of which $ 100,000 is a grant; $ 50,000 is a loan; and $ 20,000 (equal to 40% participation of the paid-in capital) is in equity investment. The private sector stockholders would provide $ 30,000 (equal to 60% of the paid-in capital) in equity investment, with perhaps $ 10,000 of this sum in initial capitalization.

Separate corporations could be created individually for each product line, or one corporation with several product lines could be developed. The latter approach provides some advantages in economies of scale for overhead and, possibly, transport costs. It also might provide some protection against profits being taken at a stage after the corporation sells its product in the event that the buyers of that product assume a majority position among the private sector shareholders. Further, given the widely different time frames for production of tea and rubber, by using one corporate structure, it might be possible to reduce over-all investment costs by setting up a financial structure whereby the profits of the earlier maturing product lines were used in part to finance the investment in slower maturing product lines.

In addition to the provisions for farmers to automatically acquire stock in the corporation, provision should also be made, from the initiation of the operation, for their participation on the Board of Directors. The combination of these two features should provide the same protection of their interests that would result from forming a cooperative, without the generally accepted drawback of cooperative management for complex enterprises.

As concerns the private sector, it is believed that the proposed financial arrangements would be attractive to Bolivian entrepreneurs.

In this connection, it is our judgement that for the type and size of entreprise contemplated, only local capital should be envisioned.

As concerns the state, the costs are the same or lower than would be required under traditional arrangements whereby the production development is provided by MACA and its attached agencies.

Finally, the Area Development Authority is provided with a source of continuing revenue from scale of its equity to farmers and from payback of the funds loaned to the Corporations to be used in a second phase of development of the Chapare.

The total estimated funding from the resources of the Area Development Authority for this component of the proposed program, assuming 3 separate corporations, is approximately US$ 6.2 million, of which US$ 1.3 million is in grant funding; US$ 3.5 million is in loans; and US$ 1.4 million is in equity participation. (It should be noted that US$ 4 million, or 64% of the total, is attributed to the cacao corporation. As pointed out later on, it is believed that by reconsidering the processing plant component of this enterprise -especially the time phasing of the construction- it may be possible to sharply reduce the financial requirements for this enterprise).

2. Vertically Integrated Corporation for Tea Production

- Background 1/

All current national production of tea is in the Alto Beni. In the early 1960, tea planting was initiated with USAID assistance but was later abandoned because of lack of a processing plant. In 1976, the Corporación Boliviana de Fomento (CBF), in association with the National Chinese Technical Mission, initiated a small farmer tea production program and constructed a pilot tea processing plant with an initial capacity of 90 MT/year of black tea, expandable to 210 MT/year. Forty five hectares have been planted, of which 26 are in production. A 120 MT plant, at a different location, is currently being considered.

The CBF program also provided for the establishment of an experimental station and nursery, and ultimately the establishment of a processing plant in the Chapare. CORDECO is responsible for the Chapare phase of the program. Since 1976, three nurseries, with a capacity of 100,000 plants each, and 4 Has. of test plantings, have been established in various areas of the Chapare. CORDECO's current

1/ Principally derived from "Perfile: Planta Beneficiadora de Té". Programa de Inversiones para el Desarrollo Rural de Alto Beni, Tomo III, MPC, ISAP, CORDEPAZ, OEA (1979): Dr. Koo, Head Chinese Technical Mission: CORDECO, observation and discussions.

development program, based on nursery capacity, will add 24 Has. of farm production a year, making a total of 52 Has. in production in 1981, (the year assumed for the commencement of the AID supported program). CORDECO has no schedule for the establishment of a plant in the Chapare.

- The Market and Prices

There is a major deficiency between the present, and projected, demand for black tea on the Bolivian market and national production. Current shortfalls are satisfied by imports. Substitution of imports by Chapare production will provide substantial benefits for the small farmer.

Table No. V B-1

National Demand for Tea, Imports and Production

	Nat. Production 2/		Imports 3/		Demand 4/
	Green leaves MT. (1)	Black Tea (Coef. 1/5) MT. (2)	Black Tea MT. (3)	Av. CIF imp. price US$/Kg. (4)	Black Tea MT. (2+3) (5)
1974	570	114	529.1	1.36	643.1
1975	650	130	342.6	1.71	472.6
1976	1,130	226	377.8	1.29	609.2
1977	1,100	220	378.8	1.73	598.2
1978	1,453	291	453.4	2.75	744.0

2/ Source: MACA
3/ Source: Instituto Nacional de Estadísticas
4/ National demand is calculated as being national production plus imports, with no account being taken of contraband.

The MACA figures of national production, the only ones available, for green tea leaf and black tea production for the years 1974-1978 are clearly in error. In order to convert green leaves to black tea a processing plant is required. The only such plant in Bolivia is the pilot plant in the Alto Beni, constructed after 1976, with a capacity of 90 MT of black tea per year. The 1978 production of black tea should be reduced by 200.6 MT. to 90 MT. to reflect actual production, and the calculated demand to 533.4 MT.

With this correction, Table V B-2 represents the projected national demand, production, and unsatisfied demand for black tea, based upon past experience and the anticipated population growth in Bolivia. In addition, it assumes and takes into account the production of the proposed Alto Beni plant's annual capacity of 120 MT. per year of black tea.

Table No. V B-2

Tea - Projected Black Tea National Demand, Production and Unsatisfied Demand 5/

	1 Demand MT	2 National Production MT	3 Unsatisfied Demand MT (1-2)
1980	632.2	113.5	518.7
1981	680.5	136.9	543.6
1982	731.6	198.4	533.2
1983	785.6	176.4	609.2
1984	842.8	209.4	633.4
1985	903.3	210.0	693.3
1990	1,262.8	210.0	1,052.8

Under the proposed program, three plants with an annual capacity of 120 MT of black tea each are to be constructed in the Chaparo. The available market demand, on an import substitution basis, will substantially exceed the total capacity of 360 MT.

Table No. V B-3 6/

	Projected Imports Black Tea MT.	Total Program Capacity Black Tea MT.
1981	583.2	120
1985	693.3	240
1990	1,052.8	360

5/ Source: "Perfil", op. cit. (Corrected)
6/ From Table V B-2

The CIF import price of tea for the period 1974-1978 averaged US$ 1.77 (equivalent to $b 35.40) per Kg.; for 1978 it was US$ 2.75 (equivalent to $b 55.00) per Kg. 7/

Average prices (in $b) at the wholesale level in La Paz for 1978 were:

Table No. V B-4

	100 tea bags (2 grs. each)	1 lb.	1/2 lb.	1/4 lb.
Imported	60.50	54.84	28.16	14.59
National	44.00	-	24.00	12.00

For the purposes of this analysis, it will be conservatively assumed that the proposed corporation's black tea selling price will be current La Paz prices for national tea as shown above.

- Tea Production

The following micro regions of the Chapare are considered suitable for tea production, and sites for promotion will be selected from them.

7/ From Table No. V B-1

Micro Region	Name
No. 2	Espiritu Santo - Paractito
No. 3	Chipiriri
No. 4	Litoral - Isiboro
No. 7	Agrigento A - Lauca Ene River
No. 8	Chimoré

Leaves produced in the test plantings of the CORDECO project have been tested in London with a "very high quality" result. This was despite the fact that the plantings from which test leaves were taken were in the Chimoré, at an altitude of approximately 600 M., which in the opinion of the Technical advisors is not optimum. This augurs well for the quality of Chapare tea production.

For tea production, land must first be cleared of all trees, stumps and logs. It is then ridged, one meter apart, and one year old plants from the nursery are planted on the ridge crown 80 cm. apart. For each 1/2 Ha., 6000 plants are required. The best planting time is just before the start of the rainy season. Harvest begins the second year after planting, increasing to full production in the 6th year.

Tea production is highly labor intensive - for planting, weeding and

particularly, harvesting. Only the top, new, leaves are picked; harvest is 20 times per year; in effect continuous. However, there is some surplus family labor available (See Section III B-5). Also, the crop would permit the use of paid labor.

The projected income of the small farmer in the program with 1/2 Ha. of tea production, is as follows:

Table No. V B-5

Year	Green Tea Production MT 8/	Gross Income a. $b 5,000/ MT	Production Costs $b 9/	Net Income $b	Cash Income $b 10/
1	0	0	12,500	(12,500)	(9,000)
2	.425	2,125	4,500	(2,475)	625
3	1,250	6,250	7,500	1,250	4,250
4	2,000	10,000	7,500	2,500	8,500
5	2,500	12,500	7,500	5,000	11,000
6th & subsequent years	3,000	15,000	7,500	7,500	13,500

8/ Based on Alto Beni experience. "Perfile" Op. Cit.

9/ Labor, the major element, is costed a $b. 50/day for both family and hired labor.

10/ Assigning $b 50/day for family labor as income.

The farmer's net, and cash, income from 1/2 Ha. of tea compares favorably with that from 1/2 Ha. of citrus, when both are in full production.

Net Income $b		Cash Income $b.	
Tea	Citrus	Tea	Citrus
7,500	6,350	13,500	7,700

- Program Development

Organization of the Corporation: A detailed feasability study will be needed. Interested private sector participants must be identified, corporate articles, financial and other arrangements agreed and documented, and the corporation organized.

Management structure will require definition, personnel will have to be recruited and adequate office facilities established. Estimated time for completion is 6 months, estimated cost is $b 250,000 (US$ 12,500).

Production: The program target is to have 300 hectares of tea planted in a 6 year period (600 farmers with 1/2 Ha. of tea each).

Table No. V B-6

year	Number of Farmers	Hectares Planted	Production Green Tea MT
0 (1980)	104	52	30.4
1	152	76	96.4
2	232	116	196.4
3	344	172	334,0
4	468	234	531.6
5	600	300	784.7
6	600	300	1,152.0
7	600	300	1,389.0
8	600	300	1,606.0
9	600	300	1,734.0

We believe that there will be little difficulty in achieving small farmer acceptance targets. Principal reasons are as follows:

a) There will be a ready market for production.

b) Tea offers better potential returns than other traditional or new crops (coca excepted) in the micro-zones selected for tea production. (Cacao is not suitable for production in tea-producing zones).

c) The farm credit program for tea production should be a powerful incentive for encouraging farmers to produce tea.

Seed and Nurseries: Tea plants are started in nurseries from seed. After 1 year in the nursery, they are transplanted to farms.

Plant requirements for the program are shown in Table V B-7.

Table No. V B-7

Tea Plant Requirements and Sources by Year

Program Year	Plant Requirements	Plant Availability 11/ From 3 Existing Nurseries	From New Nurseries
1	300,000	300,000	
2	300,000	300,000	
3	480,000	300,000	180,000
4	672,000	300,000	372,000
5	864,000	300,000	564,000
6	912,000	300,000	612,000

Adequate quantities of seed are not available in Bolivia and they must be imported from Nationalist China or other sources. Early establishment

11/ CORDECO currently has three operating tea nurseries in the Chapare with an annual capacity of 100,000 plants each.

of seed sources and supply is essential. The quantity required for 100,000 plants is 40 pounds; estimated price is $b 400 (US$ 20) per lb., a total of $b 16,000 per 100,000 plants. Scheduling of seed requirements is as follows:

Table No. V B-8

Scheduling of Seed Requirements

Year		Quantity (lbs.)	Cost US$
1		120	2,400
2		192	3,840
3		269	5,376
4		346	6,912
5		365	7,296
	Total	1,292	25,824

Table V B-8 supposes a one year lag from seed requirement to plant requirements as shown in Table V B-7. All seed is to be imported because of the specialized nature of tea seed production. The 40 pounds of seed per 100,000 plants includes provision for non-germination and plant mortality during the first year.

It is recommended that the nurseries and staff, and the continuing assistance of the Chinese Technical Mission, be incorporated into the corporation's operations. Negotiation with CORDECO to this end should be pursued upon organization of the corporation; it is suggested that CORDECO should be issued shares in the corporation (from the Authority's 40% interest). Further,

it is assumed that all seed, operating and technical assistance costs of the 3 nurseries are for the account of the corporation beginning in year 1.

In addition to the foregoing three nurseries, the establishment of six new nurseries is required for the program on the following schedule: two in year 1, two in year 2, two in year 3. Appropriate nursery location is a function of three factors:

a) When nursery production is required; b) location of, and proximity to, farms using tea plants, and c) location of processing plants for the green leaves of such farms. The foregoing scheduling will permit adequate consideration of the factors involved.

The estimated cost of establishment and the first year's operation of a new nursery with capacity of 100,000 plants per year, is as follows:

Table No. V B-9

Individual Tea Nursery Costs

	$b
(1) Tools and Equipment	
Tools	19,000
Equipment	35,000
Mower	10,000
Lumber	4,000
(2) Water	
Well drilling (incl. casing)	60,000
Water pump, pipe	13,000
Overhead tank, pipe	2,000
(3) Operations	
Seed (see above)	16,000
Fertiliser, pesticide	35,000
Plastic bags	37,200
Plastic covers	3,000

(4)	Labor	
	Caretaker	20,000
	Peons	42,000
(5)	General Fund	10,000
	Total	$b 306,200
		(US$15,310)

Estimated annual cost of operation of each nursery, after the first year, is:

Table No. V B-10

Operating Costs - Individual Tea Nurseries

(1)	Maintenance and repair		10,000	
(2)	Fertilizer and pesticide		35,000	
(3)	Labor			
	Caretaker		20,000	
	Peons		42,000	
(4)	General fund		10,000	
		$b	117,000	US$ 5,850
	Seed Costs		16,000	
		$b	133,000	US$ 6,650

The total costs for all nurseries is, then:

Table No. V B-11

Aggregate Nursery Costs

Year	Seed	Cordeco Nurseries $b	New Nurseries $b	Total $b	US$
1	48,000	351,000	612,400	1,011,400	50,570
2	76,800	351,000	846,400	1,274,200	63,710
3	107,520	351,000	1,080,400	1,538,920	76,946
4	138,240	351,000	702,000	1,191,240	59,562
5	145,920	351,000	702,000	1,198,920	59,946
6		351,000	702,000	1,053,000	52,650
				7,267,680	363,384

New nursery establishment, and the supervision of nursery operations, will be the responsibility of an Ing. Agrónomo, a corporate employee. Nurseries will be established in the sindicatos where farmers have agreed to participate in the tea production program. It is anticipated that the sindicato would provide necessary land. The nursery would be run by the corporation. Labor would be employed by the corporation. Plants will be sold to participating farmers at $b. 2.2 per plant. Nursery costs will be covered by the income received by the corporation as shown in Table V B-12.

Table No. V B-12

Nursery Costs and Returns, Cash Flow (in $b. 0000), by Year

	Year						Total	
	1	2	3	4	5	6	$b.	US$.
Nursery Income	660	660	1,056	1,478.4	1,900.8	2,006 4	7,761 6	388,080
Nursery Costs	1,011.4	1,274.2	1,538.9	1,191.2	1,198.9	1,053.0	7,267.7	363,384
Annual Cash Flow	(351.4)	(614.2)	(482.9)	287.2	701.9	953.4		
Cumulative Cash Flow	(351.4)	(965.6)	(1,448.5)	(1,161.3)	(459.4)	494.0	494.0	24,700

Green Tea Production Program: An Ing. Agrónomo, a company employee, will be responsible for all sindicato and farmer relations. He will have a perito assistant. He will select participating farmers, enter into production contracts with them, arrange for credit under the company program, advise on land selection and preparation, planting, cultural practices, problems and harvesting. He is the "company tea man" to the farmers.

His activities with farmers commence when nurseries are established in order that the farmer, and his land, are ready when plants are ready to be transplanted.

Estimated cost per year for the Ing-Agrónomo and his assistant to be incorporated in the corporate budget, is $b. 384,000.

Farm Credit: The program must be organized, and administrative procedures established, by the company as soonas feasible. Until the program is defined, the farm production program cannot be initiated.

Initially the program-approvals, documentation, record-keeping and collections are to be done by the corporation in accordance with good corporate practice and Authority requirements. As soon as feasible, it is anticipated that these functions will be performed by banks, with a corporate guarantee.

The farmer cost of planting, and costs to first harvest, for the recommended 1/2 Ha. of tea are estimated to be:

Clean clearing land	$b.	1,500		
Land preparation		2,000		
Purchase plants a $b. 2.2		13,200		
Transplanting Cost 12/		1,000		
Tools, fertilizer and insecticides		1,500		
	$b.	19,200	US$.	960.-

The credit program finances all of the above, except for farmer labor, i.e. US$.810 for each new farmer, or a cumulative total on a net basis of US$243,500. Credit terms are two year grace period, 3 year repayment, interest 13%.

Table No. V B-13

Program Credit Requirements by Year
(In $b. 000s)

	1	2	3	4	5	6
Credit Requirements	777.6	777.6	1,296	1,814.4	2,008.8	2,138.4
Repayment						
Principal			258.9	517.7	949.7	1,295.7
Interest			101.1	168.5	269.4	381.8
			360.0	686.2	1,219.1	1,677.5
Net Credit Requirements						
Annual	777.6	777.6	936.0	1,128.2	789.7	460.0
Cumulative	776.6	1,555.2	2,491.2	3,619.4	4,409.1	4,870.0

12/ Farmer labor only.

- Advisors

It is recommended that there be one qualified tea advisor, principally for production but also with respect to processing, for the corporation for a period of two years. If available, the Chinese Technical Mission would serve; if not, other qualified advisors could be engaged. The corporation budget is to include the cost of such advisor, $b. 3,600,000 (US$. 180,000). This will be covered by an Authority grant to the corporation, reflected in the corporate books as paid in surplus.

- Processing

Processing, conversion of green tea leaves into black tea, involves the following steps.

(1) Collection of green tea leaves by company trucks at the farm.

(2) The green leaves are brought to the plant and air dried.

(3) Leaves rolled.

(4) Fermentation. During this phase, trash and 80% of the water is removed. Black tea is the resulting product.

(5) Drying.

(6) Classification.

(7) Packaging.

The recommended plant size, 120 MT of black tea production annually, is an economic size, according to the Chinese Technical Mission, and permits location of the plant near production to minimize transport costs and ensure processing before deterioration of the green leaves.

Plants are to be constructed by the corporation on the following schedule based on projected green tea production, as indicated in Table V B-6:

	Year of Construction	Year in Operation
Plant No. 1	1	1
Plant No. 2	5	6
Plant No. 3	7	8

Cost of each plant is estimated to be:

Table No. V B-14

Cost of Establishing Tea Processing Plants

Land	$b.	5,000
Buildings		1,830,000
Machinery and equipment		3,199,299
Installation		290,850
Tools and utensils		95,550
Vehicles		1,480,000
Office furniture/equipment		129,150
	$b.	7,029,849
	US$.	351,492

Construction should utilize local materials to the maximum degree possible. It is recommended that the corporate budget include $b. 500,000 (US$ 25,000) for short term advisors as needed during the construction and startup of the first plant.

- Operational Phase

The operational phase is scheduled to commence in the second year of the program, upon completion of the first plant. During year one, production contracts have been entered into with participating farmers and green leaves are ready for harvest.

Green leaves will be picked up daily at the farm gate by corporation trucks. Strict scheduling will be essential; leaves must be processed within 24 hours of harvest.

During the latter part of the first year, the appropriate product mix (size of package) and pricing will have been confirmed.

Marketing and distribution arrangements will have been made. It is recommended that the corporation enter into arrangements with interested organizations presently importing tea, such as Hansa Ltda., W.R. Grace or Pacheco & Cia., Ltda. If such an organization were to be a shareholder in the corporation, presumably their interest would be grounded on marketing the corporation's production and this would be discussed at the time of incorporation.

- Financial Analysis

In accordance with the principles of organization for a vertically integrated corporation outlined previously, the private sector company will have 60% of the shares of the tea corporation, and

the Authority 40%. Board representation will be proportion to share holdings. A percentage of the Authority shares (the % to be subject to negotiation with CORDECO) will be issued to CORDECO in payment for the three existing tea nurseries. CORDECO ownership is not reflected in the analysis.

The Authority will grant an amount equal to the cost of tea advisors shown as paid in surplus in the analysis for a two year period. And the Authority will loan to the corporation an amount equal to the cost of the initial shares, excluding the paid in surplus.

From the following analysis, no further loan or shareholder funding will be required for operations or construction of the projected 2nd. and 3rd. plants. Payout on shareholder capital invested is in the 5th. year. Average annual return over the five year period is 61%. This would be an attractive return for private investors and little problem should be encountered in securing private investors for the corporation. However, there could be only limited dividends paid to shareholders, since the amortization of the loan principal from the Authority has to be paid from corporate earnings.

Table No. V B-15

Financial Analysis for Tea Production Corporation

5 Year Summary-Projected Cash Flow

In $b. (000s)

Funds Received	1	2	3	4	5	Total
A. Shareholders						
(1) Private sector shares	3,000					3,000
(2) Authority						
. Shares	2,000					2,000
. Paid in surpl. (2)	3,600					3,600
B. Loan From Authority (3)	5,000					5,000
C. Farmer/Loan Repayment, including Interest (4)			360.0	686.2	1,219.1	2,265.3
D. Tea Plant Sales (5)	660	660	1,056	1,478.4	1,900.8	5,755.2
E. Product Sales (6)		4,781.4	9,741.4	16,566.4	26,367.4	57,456.6
Total	14,260	5,441.4	11,157.4	18,731.0	29,487.3	79,077.1

TABLE V B-15 (cont.)

Application of Funds						
A. Organization Exp. (7)	250					250
B. Fixed Assets (8)	7,529.9				7,029.9	14,559.8
C. Nurseries (9)	1,043.4	1,309.4	1,575.4	1,213	1,101	6,242.2
D. Operating Costs:						
(1) Raw material (10)		482	982	1,670	2,658	5,792
(2) Salaries (11)	350	602	602	602	602	2,758
(3) Advisor	1,800	1,800				3,600
(4) Packaging (12)		545.3	1,110.9	1,389.3	3,007	6,552.5
(5) Fuel (13)		46.9	95.5	162.5	258.6	563.5
(6) Other (14)	219.6	698.7	698.7	698.7	698.7	3,014.4
Total Operating Costs	2,369.6	4,174.9	3,489.1	5,022.5	7,224.3	22,280.4
E. Farm Credit	777.6	777.6	936.1	1,128.3	789.6	4,409.2
F. Loan Repayment						
(1) Principal				1,000	1,000	2,000
(2) Interest				500	400	900
Total Application	11,970.5	6,261.9	6,000.6	8,863.8	17,544.8	50,641.6
Cash Flow (Pre-Tax)						
Annual	2,289.5	(820.5)	5,156.8	9,867.2	11,942.5	
Cumulative	2,289.5	1,469	6,625.8	16,493.0	28,435.5	28,435.5

Notes to Table V B-15

(1) Derived from "Perfile" Op. Cit.

(2) Equal to the estimated cost of a technical advisor for two years at $b. 1,800,000 per year.

(3) Terms: 2 years grace; repayment in 5 equal instalments, interest 10%.

(4) Terms: 2 years grace; repayment in 3 equal instalments, interest 13%. See Table V B-13.

(5) Tea plants sold to farmers at $b. 2.2 per plant. See Table V B-12.

(6) Calculated as follows:

For each 2,000 Kg. of green leaves processed:

	No.	Price	Total
Boxes of 100 tea bags	1,320	$b. 64.4	85,000
1/4 lb. box	984	12	11,800
1/2 lb. box	100	24	2,400
			99,200

See Table V B-6 for production schedule.

(7) Includes estimated costs of feasibility study, professional assistance and corporate organization costs.

(8) See Table V B-14 for detail.

(9) Includes all nursery establishment and operating costs.

(10) Price to farmer assumed to be $b. 5/Kg. of green tea.

(11) See "Perfil" Op. Cit. All personnel, including an Ing. Agrónomo and his assistant are included in the first year, but no direct plant labor.

(12) Calculated: for each 2,000 Kg. of green leaves processed, $b. 11,313.

(13) Calculated: for each 2,000 Kg. of green leaves processed, $b. 972.8.

(14) Includes: Maintanance and repair, insurance, administration costs, and "prestaciones sociales) at 65% of salaries and labor.

Table V B-16

Tea Corporation

Income, Expenses, Profit and Loss Summary, By Year

(in $b. 000s)

Income	1	2	3	4	5
A. Sales					
. Tea plants	660	660	1,056	1,478.4	1,900.8
. Products		4,781.4	9,741.4	16,566.4	26,367.4
B. Interest			101.1	168.5	269.4
TOTAL INCOME	660	5,441.4	10,898.4	18,213.3	28,537.6
Expenses					
A. Operating Costs; nurseries and plant.	3,381.0	5,449.1	5,028.0	6,213.7	8,423.2
B. Depr. & Amort.	623.8	623.8	623.8	623.8	1,247.6
C. Interest	-	-	-	500	400
TOTAL EXPENSES	4,004.8	6,072.9	5,651.8	7,337.5	10,070.8
NET PRE TAX PROFIT					
. Annual	(3,344.8)	(631.5)	5,246.6	10,875.8	18,466.8
. Cumulative	(3,376.8)	(3,976.3)	1,270.3	12,146.1	30,612.9
Return on Shareholder Capital ($b. 5,000,000)	-	-	105%	218%	369%

Table V B-17

Summary of Tea Program Requirements

Program requirements for the vertically integrated tea corporation, through the Authority, are:

		$b.	US$
(1)	For 40% of the share capital	2,000,000	100,000
(2)	Paid in surplus	3,600,000	180,000
(3)	Loan to the corporation	5,000,000	250,000
	Terms: 3 year grace period; repayment in 5 equal annual installments; interest 10%		
	TOTAL	$b. 10,600,000	US$ 530,000

3. Vertically Integrated Corporation for Rubber

- General Considerations

a) The market: Since the end of World War II the motorization of Western Europe and Japan together with continued expansion in North America has been a major growth phenomenon. The automative industry accounts for approximately two-thirds of total rubber consumption, and growth of the world rubber economy from 1948 to 1973 was rapid and steady at an annual rate of 6.3%. During the same period, the use of synthetic rubbers became predominant; at the moment, the world market is roughly divided 69% synthetic and 31% natural.

Production of synthetic rubbers depends on the supply of chemical feedstocks, largely petroleum based. When, in 1973 world crude oil prices quadrupled, the average cost of producing synthetic rubbers in the major industrialized countries increased from 75-100%; whereas the direct impact of the oil price change on production costs of natural rubber was less than 10%. If changes in labor costs (representing 55% of natural rubber production costs) are taken into account, then the increase was still less than 30%.

The long-term cost competitiveness of natural rubber can only be strengthened by recent and projected future increases in the price

of crude, even though total world elastomer demand is expected to grow more slowly through 1990 (5 to 5.5%, or about 1 percent per annum below the historical rate). In spite of this, overall prospects for both natural and synthetic sectors are good. Particularly from the natural rubber producers' stand point, an export market for a primary commodity which is expected to expand at 5% per annum represents an unusual growth opportunity. Moreover, the prospects are that natural rubber supply will not keep pace with demand during the decade of the '80s, and that a gap of approximately 500,000 tons is likely to appear by the end of the period. In consequence, a number of Latin American and Far Eastern producers have budgeted substantial sums for increased rubber production; on a much smaller scale, this export gap should be considered as an opportunity for the Chapare to exploit a minimum plantation of 2000 Ha., distributed at an average of 2 Has. per farm family.

It must be mentioned that because of the nature of the product, the time horizons involved in rubber growing far exceed the 5-year range of the project.

b) Micro-zones selected: Rubber presents no special problems of cultivation and can be grown in selected areas of seven of the nine micro-zones.

c) Labor conditions: As most of the labor applied to a given small-holder hectarage will consist of that supplied by the farmer and his family, we have assumed no expenses charged to labor and all income as returns to labor. At some future time it may be feasible to consider estate-type cultivation of rubber; but meanwhile we are talking about 1000 farm families each planting 2 Ha. of rubber together with leguminous cover and intercropping of annuals between the rubber trees; after the third year intercropping will be possible only in avenues because of the shade cast by the trees.

A number of assumptions have had to be made, assumptions which appear reasonable in the light of experience in the Amazon basin regions of northern Bolivia, and appropriate to the conditions which will obtain the Chapare.

a) Trees will be planted 3.4 x 6 meters, i.e., the rows of trees are 6 meters apart, and 3.4 meters apart on the rows. This gives 490 trees to the hectare, which will later have to be thinned out to get rid of poorly-developed, broken or low-yielding trees. 350-400 trees/Ha. should be the final working density.

b) After trees come into production, the half-spiral tap is used for the first three years, with tapping every other day; later a full spiral tap is used every fourth day. On the full-spiral system, the farmer can handle 300 trees per day, and each tree

should be tapped every 4th day, say 80 times a year: 80 x 375 trees/Ha. x 2 Ha. = 600,000 taps ÷ 300 = 200 man-days. However, the actual tapping and pruning, which has to be done by the farmer himself, will only take one-fourth to one-third of the time or 50-65 man-days; most of the work is in the collection of the latex plus 30 days of weeding/yr. during the first 5 years which can be done by the farmer's family.

c) Estimates of yields vary widely; we have used a low range of actual Chapare figures on the half-spiral system as follows: 35 cc. latex/day = 38 grams latex x 160 tapping days = 6.08 Kgs. latex/tree x 0.3 (dry rubber content factor) = 1.82 Kgs. dry rubber x 375 trees/Ha. = 680 Kgs./Ha.

d) Opinions of Specialists vary on the subject of preproduction time, but 7-8 years after planting appears reasonable, with full production at year 10 and after. For purposes of simplification, we are using 18 year projections, with production beginning in year 8, at an average yield of 680 Kgs./Ha.

e) Acceptance: We do not foresee any major acceptance problem, provided that it is made clear from the beginning that the Rubber Corporation will act as a business enterprise, will pay the best prices it can consistent with good management, will supply all necessary credit and technical assistance in the start-up period, but will not undertake to match Brazilian subsidized prices (see

below). In view of the time spans involved, it may be worthwhile to calculate and offer to accepting farmers a guaranteed minimum price for their crop based on a quality scale.

The acceptance rate is estimated as follows: 200 Has. cover crop in year one, 200 Has. rubber and 200 Has. cover in year two, 600 Has. rubber and 600 Has. cover in years 3, 4 and 5.

f) Returns to farmers: The Corporation will not necessarily be the sole buyer of Chapare rubber, and in order to guarantee its own supplies it will have to adjust prices regularly so as to reconcile the interests of shareholders and growers. The existing laminating plant in Riberalta, owned by private (majority) shareholders and the CBF, seems to be run on lines more philanthropic than commercial, a situation made possible by proximity to the Brazilian frontier, free passage of rubber over that frontier, and substantial subsidies on Brazilian territory to their own growers, from which Bolivian growers/collectors benefit freely. At the moment Riberalta is paying $1.90-1.95/Kg. in "bolachas", while the Brazilians are paying $2.00/Kg. or one-third more than the present New York price of $1.50/Kg.

In order to export at today's world market prices the Corporation could pay the farmer 21 pesos/Kg. and add 9 pesos for processing, transport and profit. This would yield a farm income of 14,280 pesos/Ha. per annum.

Aside from the fact that the calculation is based on today's natural rubber prices, which are well below those expected ten years from now, it also assumes an export transaction and export prices: a more realistic assumption is that Riberalta will continue to ship almost all of its production to Brazil, leaving the Cochabamba tire, spare parts and shoe market of 350-375 tons per year to the Chapare (it may be necessary to enforce the existing prohibition against imports of natural rubber in order to ensure this market).

In this case, the Corporation would sell one-fourth of its production (340 tons) at the domestic price of $3/Kg. and three-fourths (1,020 tons) at the prevailing export price of $1.50/Kg.: the domestic component of the price to the farmer could be doubled, which would give him an average return of 26.25 pesos/Kg. or 17,850 pesos/Ha. per annum. Likewise, the Corporation average selling price would become $1,875 CIF.

- Operation of the Corporation

A. Phase I - Initiation of Production

a) Genetic material: the Corporation will have to import seed and budwood, set up nurseries where rubber plants can be established and grafted, and then supply the plants to the farmer. It is proposed that the Corporation receive a grant from the Area Development Authority to cover all nursery costs, which are estimated at 10 pesos per plant or US$. 490,000 for 980,000 seedlings, plus

$10,000 worth of cover crop seed. Nursery locations will be determined by the Corporation's technical personnel in agreement with the sindicatos concerned, who will recommend nursery labor to be paid out of the Authority grant.

b) The Corporation will supply budded seedlings to farmers at the same price of 10 pesos each, plus cover crop seed during the first 3 years, after which time seed should be plentiful in the area. It will be necessary for the Corporation to furnish this material on credit according to the estimated acceptance schedule as follows:

Year	Ha.	Credit (000 pesos)
1	200	40*
2	200	1,020
3	600	3,060
4	600	2,940
5	600	2,940
		10,000

* Cover crop seed only, at 200 pesos/Ha.

Credit will be granted at 13% per annum, repayable from year 2 over 12 years.

c) The personnel of the Corporation in the initial phase will be located in rented space in Villa Tunari and divided into office and technical staff; office staff will be paid from corporate funds, technical staff out of a grant from the Area Development Authority. The Ing. Agrónomo will act as General Manager.

d) The Authority will also provide grant funds to procure and maintain two vehicles for the use of the Corporation's technical personnel during the preproduction period.

e) During this phase, Corporation technical staff will liaise with, and have to rely heavily upon, IBTA and UFLA technical assistance people. Outside advisors should not be needed unless serious problems arise with tree establishment or disease.

B. Phase II - Construction

a) In the course of year 6, the Corporation should be fully constituted and funded according to its corporate charter; in that year it will have to arrange for major construction and equipment expenditure.

b) The Board of Directors of the Corporation should appoint a General Manager with appropriate qualifications, preferably in the rubber industry, and recruit experienced production and sales managers.

c) Outside advice will be required for plant design, construction supervision and machinery specification on the usual percentage terms, unless a turn key operation is preferred by the Board; in the latter case, the additional expense, especially for small to medium-size plants, is usually more than compensated for by the efficiencies in dealing with a single contractor under appropriate safeguards; the G.M. and the Production Mgr. must be jointly involved in making recommendations to the Board.

d) A CORDENO Study done by Brazilian Consultants for a plant in Cobija, which has not been available to us, determined that a 500 gross ton installation (after 32% losses, 340 net tons) would be too small to be economical; the Riberalta plant, at 3,000 gross tons, has made a profit every year since it began in 1972: (Riberalta estimated sales in 1979 are $3 million, net profit $150 thousand). Between the two extremes we have been told by the Riberalta management that a plant of from one-third to one-half the size of Riberalta (i.e., 1,000-1,500 gross tons) would be economical because costs can be reduced in almost direct proportion to production down to a cut-off point of about 750 gross tons, 500 tons dry rubber, i.e., just above the capacity of the proposed CORDENO plant, which was not considered feasible.

e) Accordingly we are recommending the installation of a plant in the course of year 7 at a total cost of about US$. 1.2 million, based on today's approximate cost of processing about 1,500 gross

tons of rubber in "bolachas", or latex equivalent, into 1,000-1,100 tons of dry rubber, which should be adequate to handle a total planned Chapare production of 1,360 tons, coming on stream over years 8-13 and beyond.

C. Phase III - Operation

a) The collection of raw latex can be carried out in two ways, either by field coagulation into "bolachas", or by regular pick-up by truck of raw, ammonia-diluted latex for factory coagulation and processing. The latter is much the better method; the additional expense of collection should be more than covered by the better quality and price of the final product

b) The market for natural rubber has become increasingly sophisticated over the past 15 years since the first introduction of Malaysian technically-specified rubber grades, which guarantee to the buyer the percentage contents of dirt, ash, nitrogen, volatile materials, etc., together with uniformity of one block of rubber with another of the same specification. Some 35% of the world's natural rubber is now traded in this form in preference to the traditional ribbed smoked sheet. We have no information on the processes and additional costs involved in producing technically-specified rubber; but the Malaysian government has recently made available a number of full travelling scholarships to Bolivian graduate agronomists to enable them to study all aspects of rubber production in Malaysia, and immediate advantage should be taken of

this opportunity. The costs mentioned in preceding sections are based on traditional milling; it may well be that more modern processes can be economically used on a small scale. In any case, rubber takes time, and during that time the most advantageous type and degree of processing should be determined with Malaysian assistance.

c) Sales arrangements should be kept simple and inexpensive. The Corporation should have a Sales Manager, part-time commission representatives in Cochabamba and La Paz, and brokerage arrangements in New York and London.

- Financial Structure of the Corporation

As shown on the attached cash flow estimates, the Corporation will need US$. 80,000 of equity capital in the first year, and a total of US$. 1.5 million of new funds in year 7, split 50-50 between equity and loan.

The Corporation will, therefore, be capitalized at $830,000, $498,000 to be placed privately and $332,000 to be held by the Area Development Authority. The Authority will also lend the Corporation $750,000 in year 7, to be repaid in 5 equal installments at 10% interest in years 10-14 inclusive.

In addition, the Corporation will receive grants from the Authority to finance the establishment and operation of nurseries, the maintenance of a small agro-technical and extension staff during the first five years, together with transport. Total ADA grants will therefore amount to $663,000 (see breakdown below) and will be shown on the Corporation's books as paid-in surplus.

Nursery costs	$. 500,000
Salaries	108,000
Vehicles	15,000
Vehicle operation	37,500
Travel	2,500
TOTAL	$. 663,000

The financial implications of the project for the ADA are, therefore:

Equity financing		$. 332,000
Loan		750,000
Grants		663,000
	TOTAL	$. 1,745,000

-Cash Flow Estimates

a) Source of Funds

1) Farmer Credit Repayment for Seedlings provides the Corporation with the income resulting from a grant from the Authority to the Corporation of $500,000 in the form of rubber tree seedlings, shown under "application of funds" as nursery costs. This amount is reimbursed by farmers at 13% over 12 years. Because of the long time-spans involved, this formula differs from that used in the Tea Corporation, where farm credit is offset partially by tea plant sales, and nursery costs are separately accounted for. Principal and interest are calculated together, 12 years at 13%.

2) Product Sales are calculated on the basis of the given rate of acceptance per average yield of 680 Kgs./Ha. x $1,875 CIF., which is a weighted average export/domestic price.

b) Application of funds:

1) All items in parentheses are ADA grants to the Corporation;

2) Office salaries cover an accountant and a secretary in years 1-5, plus a General Mgr. in year 6 and a Sales Mgr. in year 7.

3) Technical Salaries include an Ing. Agrónomo (initially acting Gen. Mgr.) and extensionist and a secretary. From year 1-5 their salaries, transport and travel are paid for by the ADA; from year 6 , the Corporation assumes responsibility.

4) Production salary in years 6 and 7 is that of the Production Mgr.; from year 8 on, the total sum includes the manager, two mechanics at $3,600, 10 drivers at $2,700, 2 foremen at $1,200, 30 workers and 2 guards at $900.

5) Raw materials = payment to accepting farmers at 26.25 pesos/Kg. dry rubber.

6) Offices will be rented in Villa Tunari until plant and offices are built in year 7.

7) Vehicle operation expenses are calculated at 50% per annum of vehicle cost, to cover fuel, maintenance and insurance.

8) Social security = additional benefits to the labor force and is calculated as a 65% overrided on wages and salaries.

9) Loan repayment covers 5 equal installments to repay the ADA loan of $750,000; principal and interest are calculated together, 2 years grace, 5 years repayment at 10%.

Table No. V B-18

RUBBER CORP. - CASH FLOW (US$)

YEAR	1	2	3	4	5	6	7	8	9
Source of funds:									
Shareholders									
Private Sector	48000						450000		
Authority	32000						300000		
ADA Loan at 10%							750000		
Farmer credit repmt. for seedlings at 13%		338	8956	34811	59651	84493	84493	84495	84493
Product sales								255000	1020000
Total source	80000	338	8956	34811	59651	84493	1584493	339493	1104493
Application of funds:									
Plant & Eqpmt., offices							1200000		
Nursery costs (ADA)	(2000)	(51000)	(153000)	(147000)	(147000)				
Office Salaries	12600	12600	12600	12600	12600	21600	34200	34200	34200
Technical salaries (ADA)	(21600)	(21600)	(21600)	(21600)	(21600)	21600	21600	21600	21600
Production sal. & wages						9000	9000	74400	74400
Raw materials								178500	714000
Office capt. & fun.	4225								
Office Supplies	120	120	120	120	120	200	200	200	200
Vehicles (ag. use-ADA) (2)	(15000)								
Vehicles (production)								80000	
Travel ofc.	500	500	500	500	500	5000	1500	1500	1500
Travel tech. pers. (ADA)	(500)	(500)	(500)	(500)	(500)	1000	500	500	500
Office rent	1000	1000	1000	1000	1000	1000	-	-	-
Vehicle operation									
ADA yrs. 1-5	(7500)	(7500)	(7500)	(7500)	(7500)	7500	47500	47500	47500
Public utilities	270	270	270	270	270	270	2700	2700	2700
Plant op. & maint.								30000	30000
Social security, etc.	4410	4410	4410	4410	4410	33930	42120	84630	84630
Repayment of loan									
Total application	23125	18900	18900	18900	18900	101100	1359320	555730	1011230
Cash flow-annual	56875	-18562	-9944	15911	40751	-16607	225173	-216237	93263
Cumulative	56875	38313	28369	44280	85031	68424	293597	77360	170623

Continuation of Table No. V B-18

	YEAR 10	11	12	13	14	15
Source of funds:						
Shareholders						
Private Sector						
Authority						
ADA Loan at 10%						
Farmer credit repmt. for seedlings at 13%	84493	84493	84493	84493	84155	75537
Product sales	1785000	2550000	2550000	2550000	2550000	2550000
Total source	1869493	2634493	2634493	2634493	2634155	2625537
Application of funds:						
Plant & Eqpmt., offices						
Nursery costs (ADA)						
Office salaries	34200	34200	34200			
Technical salaries (ADA)	21600	21600	21600			
Production sal. & wages	74400	74400	74400			
Raw materials	1249500	1785000	1785000			
Office capt. & fun.						
Office Supplies	200	200	200			
Vehicles (ag. use-ADA) (2)						
Vehicles (production)						
Travel ofc.	1500	1500	1500			
Travel tech. pers. (ADA)	500	500	500			
Office rent	-	-	-			
Vehicle operation						
ADA yrs. 1-5	47500	47500	47500			
Public utilities	2700	2700	2700			
Plant op. & maint.	30000	30000	30000			
Social security, etc.	84630	84630	84630			
Repayment of loan	197848	197848	197848	197848	197848	--
Total application	1744578	2280078	2280078	2280078	2280078	2082230
Cash flow- annual	124915	354415	354415	354415	354077	543307
Cumulative	295538	649953	1004368	1358783	1712860	2256 167

Continuation of Table No. V B-18

	YEAR 16	17	18	TOTAL
Source of funds:				
Shareholders				498000
Private Sector				332000
Authority				750000
ADA Loan at 10%				1013915
Farmer credit repayment for seedlings at 13%	49682	24841	0	
Product sales	2550000	2550000	2550000	23460000
Total source	2599682	2574841	2550000	26053915
Application of funds:				
Plant & Eqpmt., offices				
Nursery costs (ADA)				
Office salaries				
Technical salaries (ADA)				
Production sal. & wages				
Raw materials				
Office capt. & fun.				
Office Supplies				
Vehicles (ag. use-ADA) (2)				
Vehicles (production)				
Travel ofc.				
Office rent				
Vehicle operation				
ADA yrs. 1-5				
Public utilities				
Plant op. & maintenance				
Social security, etc.				
Repayment of loan	--	--	--	989240
Total application	2082230	2082230	2082230	22319915
Cash flow - annual	517452	492611	467770	-
Cumulative	2773619	3266230	3734000	3734000

TABLE No. V B-19

RUBBER CORPORATION - PROFIT AND LOSS STATEMENT (US$)

	1	2	3	4	5	6	7	8	9
Income									
Product sales								255000	1000000
Rubber tree		338	8956	34811	59651	84493	84493	84493	84493
Sales on credit									
Total		338	8956	34811	59651	84493	84493	339493	1084493
Expenses									
Operating Costs	23125	18900	18900	18900	18900	101100	159320	475730	1011630
Depreciation Plant								60000	60000
Depreciation Other		423	423	423	423	423	423	8423	8423
Interest									
Total	23125	19323	19323	19323	19323	101523	159743	544153	1079653
Net Profit	-23125	-18985	-10367	15488	40328	-17030	-75250	-204660	24840
Cumulative	-23125	-42110	-52477	-36989	3339	-13691	-88941	-293601	-268761

TABLE No. V B-19 (cont.)

	10	11	12	13	14	15	16	17	18
Income									
Product Sales	1785000	2550000	2550000	2550000	2550000	2550000	2550000	2550000	2550000
Rubber Tree	84493	84493	84493	84493	84155	75537	49682	24841	0
Sales on credit									
Total	1869493	2634493	2634493	2634493	2634155	2625537	2599682	2574841	2550000
Expenses									
Operating Costs	1546730	2082230	2082230	2082230	2082230	2082230	2082230	2082230	2082230
Depreciation Plant	60000	60000	60000	60000	60000	60000	60000	60000	60000
Depreciation Other	8423	8423	8423	8423	8423	8423	8423	8423	8423
Interest	197848	197848	197848	197848	197848				
Total	1813001	2348501	2348501	2348501	2348501	2150653	2150653	2150653	2150653
Net Profit	56492	285992	285992	285992	285654	474884	449029	424188	399347
Cumulative	- 212269	73723	359715	645707	931361	1406245	1855274	2279462	2678809

4. Vertically Integrated Corporation for Cacao

-Background

Cacao production in Bolivia in 1978 is estimated at 3,425 MT. Over ninety percent is produced in cultivated areas and about 270 MT come from forest growth, or wild trees. Almost all the cultivated coca production is from the Alto Beni. Favorable conditions for cacao production exist in the Departments of Beni, Pando, Cochabamba and Santa Cruz - in addition to the Alto Beni.

Current world cacao prices are about US$1.35 per lb. and predictions of FAO indicate that world supply will be somewhat short of world demand over the medium term (3 - 5 years). They further predict that prices probably will never again fall so low that the crop will be unprofitable for the producer. Volume II of the reports on the cacao project in the Alto Beni[13/] projects cacao production and consumption in Bolivia from 1978 through 1988. These projections show production exceeding consumption by a slightly widening margin over the 10 year time period. If these projections are anywhere near accurate, there will be no need for further cacao imports and Bolivia will be able to export increasing quantities of cacao over the next several years.

13/ MPC, ISAP, CORDEPAZ, OEA: "Programa de Inversiones para el Desarrollo Rural del Alto Beni - Proyecto de Cacao", La Paz, Sept. 1979.

Bolivian cacao has not generally been regarded as a high quality product in world trade. It is believed that this is not due to any inherent deficiency in the cacao but rather reflects the poor fermentation and drying practices typically used.

The USDA study team on cacao and spices which had as team members outstanding authorities on all phases of cacao production, processing and marketing has recommended that the GOB undertake the necessary actions to assist small farmers to establish cacao plantations on a commercial basis in selected areas of the Chapare. It was further recommended that the GOB assist selected groups of farmers in the Chapare to establish technically appropriate cacao fermenting, drying, and storage facilities to insure high quality and value of the marketable cacao. Finally, it was recommended that the GOB provide the groups of farmers producing cacao with assistance in establishing a single marketing agency for cacao beans produced in the Chapare. The team left a preliminary report containing guidelines for the development of this activity.

-Scope of the Activity

The program for cacao production in the Chapare envisages 2,000 participating farmers, 5,000 hectares planted to cacao at the end of the sixth year and over 3,000 MT (dry weight) production at the end of a ten year period. (See Table V B-20, Cacao Program Targets.)

Participating farmers will be encouraged to plant at the rate of one-half hectare per year, or a total of 2.5 hectares over the life of the program. Farmers in the areas which have potential for cacao production have expressed considerable enthusiasm for the new crop. The areas were chosen on the basis of rainfall pattern, soil type and good drainage. The seven areas with physical potential are:

1) Ibuelo (Micro Zone No. 7)

2) Villa 14 de Septiembre (Micro Zone No. 5)

3) Todos Santos (Micro Zone No. 6)

4) Chimoro (Micro Zone No. 8)

5) Puerto Alegro (Micro Zone No. 8)

6) Valle Ivirza (Micro Zone No. 9)

7) Valle Sajta (Micro Zone No. 9)

There are almost 5,000 farmers in these areas, and it should not be difficult to enroll 2,000 for the cacao program. Over one half of these farmers have 20 hectares of land and could increase their planting to more than the 2-1/2 hectares per farm targeted. It is also likely that, if necessary, the corporation's technical personnel will be able to identify additional nearby areas for cacao production. Table III B-6 in Chapter III, "Farm Labor Profile for Typical Farm in the Chapare", indicates that there is a labor surplus for each month of the year. Therefore, labor should not be a critical constraint to the cacao program.

TABLE V B-20

CACAO PROGRAM TARGETS

YEAR		Total Farmers	New Farmers	New Ha. Planted	Total Ha. Planted	Production[14/] (in MT) Dry weight
(1)	1981					
(2)			600	300	30	
(3)		1,200	600	600	900	
(4)		2,000	800	1,000	1,900	69
(5)		2,000		1,500	3,400	179.4
(6)		2,000		1,600	5,000	368.0
(7)		2,000			5,000	1,265.6
(8)		2,000			5,000	2,134.4
(9)		2,000			5,000	2,447.2
(10)		2,000			5,000	3,385.6

14/ This column shows weight of production after fermentation and drying. Farmers production of fresh beans will actually be three times the amounts in this column.

-Cultural Practices for Cacao

Each farmer is responsible for preparing his own land, transplanting seedlings and attending to the cultivation of cacao on his farm. He will be trained and assisted by the corporation cacao technician.

This training will usually be done by groups at the sindicato level, but on a centrally located farmer's plot. Cacao can be successfully transplanted to fields in the Chapare throughout most of the year[15/]. Plants will be spaced in rows 3 meters apart and 3 meters between plants in the row. This 3M x 3M staggered planting configuration will allow 1,111 plants per hectare. Bananas or platano will be planted in alternate rows at 3 meter spacing to provide shade and an intermediate cash crop. Centrosima or stylosanthis may be planted as a ground cover to control weeds and to add nitrogen to the soil. (Neither the costs nor the benefits of the intermediate cash crop and the ground cover have been included in calculations which follow.)

Each farmer will be responsible for harvesting the cacao pods, separating the beans and placing them in clean containers for sale at the farm or sindicato level. Typically, farmers will harvest cacao about once every two weeks during the eight month harvest season. The schedule of farm harvesting and sale of wet cacao beans will be planned and coordinated by the corporation, which is responsible for the assembly, processing, and marketing of the cacao.

15/ It is common practice in the Alto Beni for farmers to plant an annual crop such as rice between the time land is cleared and cacao is planted.

The corporation will buy and take title to wet cacao beans at the farmer or sindicato level. The corporation will collect the wet cacao in pick-up trucks within 24 hours of harvest and transport it to one of the processing facilities that will be built during the five year period. Each processing center will have facilities to ferment, dry and store cacao beans.

-Individual Farmer Costs and Returns

Farmers participating in the program are expected to plant a half hectare the first year and additional hectarage in subsequent years up to a total of 2-1/2 hectares per farmer, on the average. The assumed schedule of planting, yields and production is shown in Table V B-21 below.

TABLE V-B-21

ASSUMED SCHEDULE OF PLANTING, YIELDS, AND PRODUCTION FOR THE INDIVIDUAL FARMER *

Year	Total Ha. Planted	Yield by Year of Planting	KG/HA. Av. Yield	Total Farm Production
1	0.5	--	--	--
2	1.0	100	100	50
3	1.5	175	140	140
4	2.0	250	175	260
5	2.5	350	220	440
6	2.5	400**	255	640
Full Production	2.5	680	680	1,700

* All yield and production data is in Kg. of dry weight.
** Maximum average yield.

Table V B-22 shows implantation and production costs to the farmer up to first harvest for 1/2 hectare of cacao. The farmer will need about US$300 in credit for his first half hectare and US$130 in each of the two subsequent years. Purchase of plants and chemicals for subsequent plantings is the major out-of-pocket expense.

On the basis of the above schedule of plantings, yields, production and costs, and at a price of $b30 per kg.[16] it is estimated that a farmer could be operating at a profit by the fourth year of the program and have completely recouped his investment by year six. At full production, a farmer stands to make as much as $b50,000 (excluding labor costs) on 2-1/2 hectares of cacao.

16/ $b30.00 per kg. dry weight equivalent. The farmer actually sells fresh beans to the corporation at about $b10.00 per kg.

PN-AAM-983

511000U/62

REGIONAL DEVELOPMENT OF THE TROPICAL CHAPARE OF BOLIVIA

VOLUME II

WORK ORDER No. 3

November, 1979

Multinational Agribusiness Systems, Inc.
IQC No. AID/SOD/PDC-C-0188

TABLE V B-22

ESTIMATED FARMER COSTS AND CREDIT NEEDS PER 1/2 HA. TO FIRST HARVEST

First Year	
Land Preparation *	$b 2,000
Plant purchase at $b3.5 per plant	1,946
Transplanting *	200
Sprayer and Tools	3,000
Insecticides and Fungicides	500
Second Year	
Insecticides and Fungicides	500
TOTAL	$b 8,146
Less farmer labor	2,200
Amount to be financed	$b 5,946 (US$297.30)

Farmer labor not to be financed.

-Corporation Start Up and Production Development Phase

There will be certain expenses involved in organizing the corporation, e.g., lawyer's fees, registration fees. These are estimated at $b250,000. Also, there will be a need for a certain number of personnel and their support costs during this phase. These can be divided into two categories:

(a) technical personnel (who perform a role similar to that of the extension service if this function were to be provided by the government) and whose costs during an initial five year period, are therefore proposed to be handled as a grant by the Area Development Authrority to the Corporation, with these amounts reflected on the Corporation's books as paid in surplus. It is estimated that two Ingeniero Agronomos and two technical assistants will be needed. Their cost and that of 2 jeeps and 2 motorcycles, plus the operating costs of the vehicles comes to $b4,749,000 over the five year period, the time needed for the corporation to begin producing a positive annual cash flow.

(b) Administrative and management personnel, who should be paid from corporate equity funds. It is estimated that an accountant and two secretaries will be needed in year one of the program, a general manager in year three (one of the Ingeniero Agronomos can act in this capacity until then), and a sales manager in year four.

(c) In addition, there may be a need for short term consultants, both in connection with the development of production and in installing and operating the first processing plants. We are budgeting US$50,000 per year for this purpose and propose that this be financed by a grant from the Area Development Authority if and when needed.

-Nursery Operations

During the production development phase, the major effort will involve setting up nurseries, arranging for farmer acceptors, and providing the latter with technical assistance -- all with and through the sindicatos.

Apparently there are 2 or 3 newly established nurseries in the Chapare, but the team has no further information about them.

Table V B-23 "Seed and Plant Requirements", shows seed requirements, suggested source of seed costs, and plants available for distribution to participating farmers. This table supposes a 15 percent loss from planting of seed until the seedlings are ready to transplant. Cacao seedlings are normally transplanted when they are six months old.

TABLE V B-23

SEED AND PLANT REQUIREMENTS

Year	Seed Required 1/	Source 2/ Alto Beni No. Plants	Alto Beni Cost $b (000's)	Imported No. Plants	Imported Cost $b (000's)	Total Cost	Plants Required for Distribution
1	383,295	383,295	383.3			383.3	-o-
2	766,820	766,820	766.8			766.8	333,300
3	1,277,650	800,000	800.0	477,650	621.0	1,421.0	666,800
4	1,916,475	800,000	800.0	1,116,475	1,451.4	2,251.4	1,111,000
5	2,044,240	800,000	800.0	1,244,240	1,617.5	2,417.5	1,666,500
6							1,777,600
TOTAL	6,388,480	3,550,115	3,550.1	2,838,365	3,689.9	7,240.0	5,555,200

1/ Plants required plus 15%, as recommended in "Cacao and Spices", Preliminary report of USAID PASA Team to Bolivia

2/ It is assumed that seed from Alto Beni costs 1 peso each and that imported seeds will cost 1.3 pesos each.

The schedule for establishment of nurseries is shown in Table V B-24. Location of nurseries should be determined by technical personnel considering:

a) Location of new cacao plantations.

b) Optimum soil and climatic conditions for nurseries.

We recommend a total of eighteen nurseries with an annual capacity of 100,000 plants (or seedlings) each. Production begins in the second year of nursery life. Size and number of nurseries may be varied according to experience of the cacao corporation in its initial stages. A nursery of the size recommended will cost about US$15,000, excluding cost of seed and vehicles and including the first year's operating costs. Table V B-25 gives a breakdown of these costs. Annual operating costs for such a nursery are shown in Table V B-26. Note that seed costs are not included.

Table V B-27 summarizes costs for the overall nursery component of the cacao program - about one million dollars after six years. Aggregate seed costs by year are included in this Table.

Nursery income consists of sales of seedlings to farmers at $63.50 each. Costs, income and annual cash flow are summarized in Table V B-28. The largest deficit occurs in year four ($65,058,000). Nurseries should be "out of the red" by the fifth year's operation and have recouped their cumulative losses by the end of the sixth year.

TABLE V B-24

NUMBER OF NURSERIES REQUIRED

Year	No. of New Nurseries Required	Total In Operation
1	4	4
2	3	7
3	5	12
4	5	17
5	1	18
6		18

TABLE V B-25

ESTIMATED COST OF NEW NURSERY ESTABLISHMENT

PLUS FIRST YEARS OPERATION (EXCLUDING SEED)

		Sb. (000's)
(1)	Materials, tools, equipment	
	Tools and equipment	54
	Mower	10
	Lumber	4
(2)	Water	
	Well drilling (Incl. casing)	60
	Water pump, pipe	13
	Overhead tank, pipe	2
(3)	Operations	
	Fertilizer, pesticide	35
	Plastic planting bags	37.2
	Plastic covers	3
(4)	Labor	
	Caretaker	20
	Peons	42
(5)	Miscellaneous	10
	TOTAL	Sb. 290.2
		(US$14,500)

TABLE V B-26

ESTIMATED COST OF NURSERY OPERATION IN 2ND. AND SUBSEQUENT YEARS (EXCLUDING SEED)

		$b. (000's)
(1)	Maintenance and repair	10
(2)	Fertilizer and pesticide	35
(3)	Labor	
	Caretaker	20
	Peons	42
(4)	Miscelaneous	10
	TOTAL	$b. 117,0
		(US$5,850)

TABLE V B-27

TOTAL ESTIMATED NURSERY COSTS BY YEAR

Year	Seed Costs 1/	Nursery Costs 2/	Total Costs $b. (000's)	Total Costs US$
1	383.3	1,160.8	1,544.1	77,205
2	766.8	1,338.6	2,105.4	105,270
3	1,421.0	2,270.0	3,691.0	184,550
4	2,251.4	2,855.0	5,106.4	255,320
5	2,417.5	2,279.2	4,696.7	234,835
6		2,106.0	2,106.0	105,300
	7,240.0	12,009.6	$b. 19,249.6	US$ 962,480

1/ An estimated 800,000 seeds per year are available from Alto Beni nurseries at about $b. 1.00 each. Imported seeds cost about $b. 1.30.
2/ Includes establishment costs and operating costs.

TABLE V B-28

CASH FLOW; NURSERIES AND SEED

$b. (000's)

	1	2	3	4	5	6	TOTAL $B.	TOTAL US$
Income[1/]		1,166.6	2,333.8	3,888.5	5,832.8	6,221.6	19,443.3	972,165
Costs	1,544.1	2,105.4	3,691.0	5,106.4	4,696.7	2,106.0	19,249.6	962,480
Cash Flow								
Annual	(1,544.1)	(938.8)	(1,357.2)	(1,217.9)	1,136.1	4,115.6		
Cumulative	(1,544.1)	(2,482.9)	(3,840.1)	(5,058.0)	(3,921.9)	193.7	193.7	9,685

1/ Seedling price to farmer $b. 3.5 per plant.

-Farmer Credit

As indicated earlier, each farmer acceptor will require approximately US$500 in credit over the first three years. The credit will be provided at 13% interest, with a 2 year grace period and a 3 year repayment period.

Table V B-29 summarizes the credit component of the program. As can be seen the peak capitalization for this element of the corporation's costs occurs in year 4, the same year that farmers begins to repay their loans. On a cumulative basis, there is a net outlay for credit until the 8th year of the program, but by the 5th year repayments begin to be larger than new credit extended.

TABLE V B-29

FARM CREDIT COMPONENT ($b. 000)

	2	3	4	5	6	7	8	9	10	Total
Credit Requirement (Outlays)	3,567.6	5,039.2	7,692.0	3,424.4	1,955.8	-	-	-	-	21,676.0
Repayment (income)										
Principal	-	-	1,189.2	2,867.6	5,431.5	5,383.0	1,357.8	1,793.8	652.3	21,676.0
Interest	-	-	463.8	963.8	436.4	1,330.0	884.5	318.0	84.8	4,481.3
Total	-	-	1,653.0	3,831.4	5,867.9	6,713.0	5,242.3	2,111.8	737.1	26,157.3
Net Credit Requirement										
Annual	(3,567.6)	(5,035.2)	(6,039.0)	407.0	3,911.1	6,713.8	5,242.3	2,111.8	737.1	
Cumulative	(3,567.6)	(8,602.8)	(14,641.8)	(14,234.8)	(10,323.7)	(3,611.9)	1,630.4	3,742.2	4,479.3	

-Construction Phase

It is recommended that all fresh beans be processed (fermented and dried) in central facilities rather than on the farm for the following reasons:

a) Bolivian cacao is currently of low quality, primarily because of substandard farm-level processing.

b) Significant savings will result from centralized marketing, storage and transportation.

Processing plants of the type recommended for the program will produce about 500 MT of dry cacao from 1500 MT of fresh beans per year. These are considerably larger than the type of plant discussed in some detail in "Proyecto de Cacao" cited earlier in the text. We have interpolated from the construction costs of the small plants and arrived at a construction and equipment cost of ten million pesos per 500 MT capacity plant.

Location of plants depends primarily on location of production because processing of fresh beans must be initiated within 24 hours of harvest. We are planning for a pick up service to be provided by each plant to the farmer in its area of influence. For these reasons we have tentatively programmed for the construction of 2 plants each in program years 3, 4 and 5, even though installed capacity will overwhelmingly exceed anticipated production. (See Table V B-30) When detailed feasibility studies are undertaken, it may be found advantageous

to postpone construction of most of these plants and to increase the pick-up truck fleet in the early years. Such a change, while it might increase operating costs, would favorably influence the cash flow projections from what is shown in Table V B-31.

TABLE V B-30

PLANT CONSTRUCTION SCHEDULE

Year	Number Construction	Plants on Stream	Plant Capacity (MT dry cacao)	Raw Mtl. Availability (MT dry weight)
1				
2				
3	2	-	-	-
4	2	2	1000	69
5	2	4	2000	180
6	1	6	3000	368
7	-	7	3500	1265
8	-	7	3500	2134
9	-	7	3500	2447
10	-	7	3500	3386

To take account of the operation of the plants at a below capacity level in the first six or seven years, we have estimated operating costs on the following basis:

Program Year	Cost per MT of Production (in $b)
4th	8,000
5th	7,000
6th	6,000
7th	5,260
Subsequent years	5,260

The cacao corporation will be funded 50% by stock issues and 50% by a loan from the Development Authority. Sixty percent of the stock will be held by the private sector and 40% by the Development Authority. The loan from the Development Authority will not be required until the third year if stock is subscribed as scheduled[17/]. The financial analysis for the corporation (see Table VB-31) shows a cash balance of over 21 million pesos at the end of five years. However, production is only beginning and the corporation has a debt of 50 million pesos at this stage of operations. This debt is scheduled for liquidation by year 16 of the program at which time there will be a positive cash balance of over 120 million pesos if dividends are not declared.

Financial implications for the Area Development Authority in US$ are:

Equity financing	1.0 million
Loan	2.5 "
Grant	.5 "
Total	4.0 million

17/ If, as indicated in the previous section, plant construction is delayed, both the ADA loan and the call up of stock payment can be consi erably postponed.

TABLE V B-31

FINANCIAL ANALYSIS FOR CACAO PRODUCTION CORPORATION ($b.000)

	1	2	3	4	5	5-year Sub-total
FUNDING AND SALES 1/						
A. Shareholder						
1. Private sector	3,000	27,000				30,000
2. Development Authority:						
-Shares	2,000	18,000				20,000
- -Paid in Surplus 2/	2,409	1,835	1,835	1,835	1,835	9,749
B. Loan from Dev. Authority			50,000			50,000
C. Farm Loan Repayment 3/ including interest				1,653	3,831	5,484
D. Sales of Cacao Seedlings 4/		1,167	2,334	3,888	5,833	13,222
E. Sale of Dry Cacao 5/				3,450	8,970	12,420
TOTAL FUNDING AND SALES	7,409	48,002	54,169	10,826	20,469	140,875
APPLICATION OF FUNDS						
A. Corp.Organization Costs	250					250
B. Corp.Mgmt. Expenses 6/	540	540	720	900	900	3,600
C. Technical Personnel 7/	720	720	720	720	720	3,600
D. Advisor 8/	1,000	1,000	1,000	1,000	1,000	5,000
E. Vehicles and POM 9/	689	115	115	115	115	1,149
F. Establishment & Operations of Nurseries 10/	1,544	2,105	3,691	5,106	4,697	17,143
G. Fixed assets - Plant & Equipment 11/			20,000	20,000	20,000	60,000
H. Operating Costs 12/				550	1,260	1,810
I. Raw Material 13/				2,070	5,382	7,452
J. Farm Credit 14/		3,568	5,035	7,692	3,424	19,719
K. Loan Repayment 15/						
1. Principal						
2. Interest						
TOTAL APPLICATION	4,743	8,048	31,281	38,153	37,498	119,723
CASH FLOW						
-Annual	2,666	39,954	22,888	(27,327)	(17,029)	21,152
-Cumulative	2,666	42,620	65,508	38,181	21,152	

Continuation of Table V B-31

	6	7	8	9	10	Total
FUNDING AND SALES						
A. Shareholder						
1. Private Sector						30,000
2. Development Authority :						
-Shares						20,000
-Paid in Surplus						9,749
B. Loan from Dev. Authority						50,000
C. Farm Loan Repayment including interest	5,868	6,714	5,242	2,112	737	26,157
D. Sales of Cacao seedlings	6,222					19,444
E. Sale of Dry Cacao	18,400	63,250	106,720	122,350	169,280	492,420
TOTAL FUNDING AND SALES	30,490	69,964	111,962	124,462	170,017	647,770
APPLICATION OF FUNDS						
A. Corp. Organization Costs						250
B. Corp. Mgmt. Expenses	900	900	900	900	900	8,100
C. Technical Personnel	720	720	720	720	720	7,200
D. Advisor						5,000
E. Vehicles and POM	115	115	115	115	115	1,724
F. Establishment and Operations of Nurseries	2,100					19,249
G. Fixed assets - Plant & Equipment	10,000					70,000
H. Operating Costs	2,210	6,650	11,200	12,800	17,500	52,170
I. Raw Material	11,040	37,950	64,032	73,416	101,568	295,458
J. Farm Credit	1,957					21,676
K. Loan Repayment						
1. Principal	5,000	5,000	5,000	5,000	5,000	25,000
2. Interest	3,137	3,137	3,137	3,137	3,137	15,685
TOTAL APPLICATION	37,185	54,472	85,104	96,088	128,940	521,512
CASH FLOW						
-Annual	(6,695)	15,492	26,858	28,374	41,077	126,258
-Cumulative	14,457	29,949	56,807	85,181	126,258	

Notes to Table V B-31

1/ Required funding is:

Loan	50%
Shares	50%
	100%

Shareholding at time of issue:

Private	60%
Dev. Auth.	40%
	100%

2/ Paid in surplus represents a phased grant from Area Development Authority for technical personnel, advisor, and their vehicles and petrol, oil and maintenance costs (2 jeeps and 2 motorcycles). This grant covers the first 5 years of operation only.

3/ See Table V B-29. Terms: 13% interest, 2 year grace, 3 year repayment schedule.

4/ Seedlings sold to farmer at 3.5 pesos each. See Table V B-28.

5/ Price of dry cacao was assumed to be in line with NY future price for early 1980 (less 15% for freight handling and insurance) or 50 pesos per Kg. Bolivian cacao from the Chapare should command better relative prices than Bolivian cacao now receives, as it is anticipated that the quality will be better. See Table V B-20 for schedule of production.

6/ Salaries for 1 General Manager, 1 Accountant, 1 Sales Manager and 2 Secretaries.

7/ Technical personnel for dealing with farmers includes 2 ingeniero agrónomos and two assistants.

8/ Part-time basis.

9/ Two 4-wheel drive jeeps and 2 motorcycles. Petrol, oil and maintenance estimated at 20% of vehicle cost. Vehicles are for farmer liaison staff and advisors only. Vehicles for plant operation and cacao collection included under item G.

Continuation of Notes to Table V B-31

10/ See Tables V B-25 and V B-26. Includes all costs for establishing and operating nurseries.

11/ Processing plants only.

12/ Processing plants only.

13/ Price to farmer - 30 pesos per Kg., dry bean equivalent.

14/ See Table V B-29 for farmer credit requirements.

15/ Repayment of loan from Development Authority. Terms: 10% interest, 2 year grace period, ten year repayment schedule. Calculated on the basis of ten equal payments.

$$PMNT = PV \left(\frac{.1}{1-(1+r)^{-n}} \right)$$

TABLE V B-32

INCOME, EXPENSES, PROFIT AND LOSS SUMMARY FOR CACAO CORPORATION, BY YEAR
($b. 000)

	1	2	3	4	5	6	7	8	9	10
A. INCOME										
1. Sales:										
-cacao seedlings		1,667	2,334	3,889	5,833	6,222				
-cacao products				3,450	8,970	18,400	63,250	106,720	122,350	169,280
2. Interest:										
-On farmer loans				464	964	430	1,330	885	318	85
TOTAL INCOME		1,667	2,334	7,803	15,767	25,058	64,580	107,605	122,668	169,365
B. EXPENSES										
1. Operating costs nurseries & plants	592	912	1,559	2,694	3,397	4,316	6,650	11,200	12,800	17,500
2. Depreciation & amortization of debt		38	67	1,448	2 829	9,172	9,839	9,839	9,839	9,839
3. Interest on loan from Dev. Auth.						3,137	3,137	3,137	3,137	3,137
TOTAL EXPENSES	592	950	1,626	4,142	6,225	16,625	19,676	24,176	25,776	30,476
NET PRE TAX PROFIT:										
.Annual	(592)	717	708	3,661	9,542	8,433	44,956	83,429	96,892	138,889
.Cumulative	(592)	125	833	4,494	14,036	22,469	67,425	150,854	247,746	386,635

C. OTHER PRODUCTION LINES

This Chapter deals with specific program elements proposed for implementation under the Research and Extension component of the proposed program. These program activities are: 1) the rotation system package, including multiple cropping and seed multiplication; 2) swine production; 3) citrus improvement; 4) pineapple; 5) pejivalle; 6) an animal production center; and 7) minor emphasis crops, including spices and coconuts. None of them are considered suitable for development via vertically integrated corporations.

The content and scope of each activity will be discussed below, as will management arrangements. What the farmer should do, how the activity is designed to help him, and the returns or benefits to the farmer will be covered. Since from a program cost viewpoint, the personnel and other cost items overlap amongst the various activities, the detailed cost estimates for implementation will be dealt with in the following Chapter on "Research and Extension".

It should be noted that rather ambitious targets are suggested for the several activities. These are believed feasible if each activity is examined independently. When looked at in the aggregate, it is doubtful that all can be achieved simultaneously, especially when the innovations to be promoted by the corporations are also taken into

account. Our reason for presenting the data in this form is that there is no way of anticipating which activity will gain acceptors at what rate. It is hoped that, at least to some degree, the problem can be alleviated by programming only certain mixes of new activities for individual micro-regions during the operational planning phase. We do think it important that provision be made for moving ahead with all program elements indicated, in more or less simultaneous fashion, whatever the individual acceptor rates, so as to provide for sufficient diversification choices to the individual farmer within an over-all system adapted to the region.

It will also be noted that fertilizer has not, in general, been recommended for the crops discussed. This omission is intentional. Fertilizer costs are extremely high in Cochabamba (US$22 for one hundred pounds of 15-15-15). Farmers are currently under-capitalized and are not accustomed to using fertilizer. After tree crops have begun to yield cash returns and results from fertilizer response experiments are available, it is anticipated that sound recommendations for fertilizer can be made and implemented. In the meantime, in-country sources of rock phosphate and lime should be thoroughly explored.

1. Rotation System Package

-Scope

This activitiy is designed to change the farming system for annual crop production in the Chapare from the traditional "slash and burn" to multiple cropping followed by a two year legume fallow and to establish the practice of maintaining a legume ground cover under perennial crops.

-Content

In order to accelerate the adoption of the new technology, farmers will be assisted through credit and technical assistance to: i) obtain and plant improved seed utilizing recommended cultural practices for annual crops; ii) obtain and plant at least one hectare of kudzu or other recommended legume each year; iii) where livestock is to be installed, fence one hectare per year as soon as the legume has been established; iv) build a 3 m x 4 m grain storage shed.

This activity also provides for a detailed survey of the Chapare to locate specific sites having optimum conditions for paddy rice culture and for carrying out production trials to introduce the new production technologies. Engineering and feasibility studies of irrigation systems will eventually be conducted if paddy rice looks promising from the agronomic point of view.

Finally, the activity will establish a seed multiplication and distribution system for legume and annual crops.

-Management

The technical and practical management of this activity will involve much of the research and extension network which will be headquartered at the stations of La Jota and Chipiriri and have field agents in each of the nine micro-regions. More specifically, the activity will require the following Bolivian technical personnel: a three-man team at the ingeniero agrónomo level, composed of a farming systems and legume specialist, who will also act as activity leader; a food and field crops specialist; and a seed multiplication and distribution specialist. These technicians will work in close coordination with the veterinarian and swine production technician. The team will receive cooperation and assistance from the economist, the extension information technicians and other research and extension personnel at the station level as required. At the field level the team will be assisted by the personnel stationed in each of the nine micro-regions. The field level extensionists will work with farmers through the network of sindicatos in activity implementation. Additionally, the package team will be assisted on a full time basis by one foreign advisor who will be an agronomy specialist in farming systems. Other advisor assistance on a part time basis will include help from a soils agronomist, an agricultural economist and an extension communications specialist.

-Rates of Adoption

For cover crop/forage use, fencing, and construction of grain storage

ieds - all key elements in the rotation system package - the following loption rates were established as targets:

i) Legume Cover Crop/Forage

Year	New Farmers	Hectares Planted	Seed Requirement (kg)
1	100	100	200
2	400	500	1,000
3	500	1,300	2,600
4	1,800	2,700	5,400
5	1,800	3,600	7,200
TOTAL	5,000	8,200	16,400

It is assumed that 100 farmers will enter the program in year 1 and plant one ha. of legumes each. These same farmers will plant one additional ha. of legumes in year 2 for a maximum of 2 has. of cover/crop forage per farm. Hopefully, a majority of Chapare farmers will be producing one or more hectares of legume cover/crop forage by year 10 of the program.

Seed cost is estimated at US$10.00 per kg. for imported seed and $b6,000 for seed produced locally. Seeding rate is 2 kg. per ha. Two hundred kgs. of seed will have to be imported the first year of the program and 300 kgs. the second year.

ii) Fencing

Year	Area in Legume (Ha.)	Fencing Requirements (Has.) First Year	Second Year
1	100	100	
2	500	400	100
3	1,300	900	400
4	2,700	1,800	900
5	3,600	1,800	1,800
TOTAL	8,200	5,000	3,200

Approximately 400 meters of fencing are required for one hectare. To fence a second hectare, a farmer can use one side of an existing fence. Five strands of barbed wire and 80 wooden posts per hec are are recommended.

iii) Grain Storage Sheds

Year	Farmers	Sheds
1	100	100
2	400	400
3	900	900
4	1,800	1,800
5	1,800	1,800
TOTAL	5,000	5,000

The shed should be made largely from on-farm materials and rough lumber from the Chapare. Roofing, 1/4 inch wire mesh, and hardware will have to be brought in. Buildings will be 4 m x 3 m x 4 m high, and will be mounted on posts at least 50 cm. above ground level. All interior surfaces must be covered with 1/4 inch wire mesh to keep out rats. The roof will be shed type with a 1 m overhang on all sides. Such a shed is estimated to cost about $B 8,000.

-Seed Multiplication and Distribution

From field observation in the Chapare it was evident that the annual crops currently being grown are from extremely poor seed. Pure, high quality disease free seed for most agronomic crops have the potential to more than double production per unit area. A brief listing of the possibilities for some major food crops adapted to the Chapare will point up advantages to the farmer from a simple seed multiplication and distribution program element. To undertake this activity will require installing a limited amount of storage and processing facilities for seed in the 2 central stations of La Jota and Chipiriri.

a) Rice: The need for a paddy rice survey was referred to earlier. Meanwhile, there are varieties of upland rice developed by CIAT currently under observation at the La Jota station. As varieties superior to those now in use are identified they should be immediately multiplied and distributed.

b) Beans are becoming an important source of protein in the diets of migrants and other lowland people. In the Chapare, beans have not become important as a food crop; perhaps because most varieties do not do well under high rainfall conditions. The black bean, however, can stand higher rainfall and has done well in trials at the La Jota station. If beans are included in cropping systems, a program of virus free seed acquisition and distributions will have to be organized, because production of disease free seed in the Chapare does not seem practical.

c) Root Crops: Soils and climatic factors in the Chapare favor the production of a wide range of root crops. Yuca, malanga, yautia, and sweet potatoes have a place in the integrated cropping pattern. Better seed and plant material needs to be identified and made available to farmers.

d) Vegetables: These form an important part of the diets of the Chapare farm families. Some vegetables should be tested for better varieties and disease resistance, principally tomatoes and sweet peppers.

e) Legumes form the key element in the rotation system package. Both the La Jota and Chipiriri stations have observation trials underway for a number of promising legumes that can be utilized in the package for forage as well as for ground cover under tree crops. Continued observational trials should be made on current and newly introduced varieties.

The seed multiplication system will be principally concerned with variety testing, multiplication and distribution of improved varieties of the crops listed above. As the best varieties available are identified, the basic germ plasm will be multiplied at the experiment station level to produce foundation seed. The foundation seed will be placed with selected cooperating farmers throughout the Chapare for the production of pure improved seed for sale or "in kind" trade to large numbers of farmers who adopt the "package". The program will be guided at the field level by the extension agents working through the sindicatos. Certain seed that are expensive and in high demand may be grown under contract with farmers and purchased by the farming systems section for carefully directed distribution.

Annual crop seed of recommended varieties can be procured in country and multiplied in the Chapare. For legume cover crop and forage seed the situation is somewhat different. By year five of project implementation there should be approximately 8,200 has. of legume cover and forage crops growing in the Chapare. This means that unless massive multiplication of legume seed takes place early, there will be a severe constraint to seed supply. The constraint can be partially alleviated by vegetative propagation of Kudzu and some other species. However, importation or local procurement of about 1,600 kgs. of seed will be required to initiate the program. Subsequent seed can be produced in the Chapare.

-Farmer Benefits

The returns to the farmer from adoption of the "package" are many and varied. Some of these returns are difficult to evaluate in money terms. For example, multiple cropping should result in more crops per year with higher yields than from traditional methods, especially after introduction of a legume fallow.

Another approach is to calculate the value of the nitrogen fixed in the soil by a legume cover crop. Two hectares of kudzu can fix approximately 160 kgs. of nitrogen per year. This is equivalent to 765 pounds of 46% urea, which currently costs $B 3,360 in Cochabamba. Cost of mechanical cleaning in the Chapare is currently estimated at $b 6,000 per hectare. After two years of kudzu cover, this cost should be reduced by approximately 50%.

If a farmer decides to use his two hectares of legume as forage for pigs, it will easily support 10 feeder pigs per year to a market weight of 100 kgs. each. The net cash return on such an operation would be approximately $b 15,750. The same two hectares could be used, ultimately, to support two bovine animal units (oxen, buffalo, beef or dairy animals).

The construction and use of a grain storage shed might reduce losses on basic grains produced of up to 25% of the value of the crop.

2. Swine Production

This activity is designed to establish the swine industry in the

Chapare as a major source of annual income for small farmers through the implementation of a low cost production system based upon legume forage and farm surplus or waste produce. The production unit described is illustrative and has numerous variations in actual practice. By year five, the Chapare should be marketing well over 10,000 market hogs per year through commercial channels.

-Technician Requirements

Success of the program is contingent upon sound management practices plus intensive sanitation and disease prevention. One technician with the full assistance of a swine production specialist, as advisor, will lead program implementation. They will be working closely with two veterinarians. One will be required as soon as the program starts and the second one at the beginning of the third project year. This team will be assisted at the sindicato and farm level by the zonal extensionist. Much of the work required to train the farmers and manage the program will have to be done with the active cooperation of the sindicatos.

-Foundation Breeding Stock

Breeding stock will come from herd increases at the Chipiriri station, which has just procured foundation stock of Duroc, Hampshire and Yorkshire breeds. The La Prada herd belonging to the University of Santa Clara is another source. In addition, good breeding stock is also available from private producers.

-Distribution System and Adoption Rates

In the second half of the first year of the program, or as soon as the legume has covered the ground and fencing has been put in, 90 sows and 15 boars will be sold to a minimum of 15 farmers interested in setting up breeder herds. The basic herd to be managed by a farmer with aptitude and interest in swine management is 6 sows and 1 boar. It is expected that only one in ten, or perhaps 20, farmers will have the capability and inclination to become involved in a swine breeding exercise.

It is assumed that each sow will have two litters per year with an average of five weaned feeder pigs per year. It is further assumed that the six sows combined will have 15 additional pigs per year, which will be used for breeder herd growth and replacements.

Based on these assumptions, and assuming further that both the breeding center and farmers to whom they sell breeding stock will sell to other farmers, it can be projected that a minimum of 570 farmers will be engaged in swine operations by the fifth year of the program, with a progression more or less as follows:

Year	Breeder Sows	Herd Boars	Feeder Pigs
1	90	15	-
2	270	45	900
3	540	90	2,700
4	1,080	180	5,400
5	1,440	240	10,800
	3,420	570	19,800

-Production System

Farmers may farrow and fatten on the same farm. This can be varied by sales of feeder pigs to other colonists permitting the buyers to market some of their produce through swine. A further variation would be for four or five farmers to have sows and share a boar. In any event, the system of operation suggested is one in which the hogs are fed a mineral mix and minimum rations of concentrates, with the bulk of their feed coming from kudzu, stylosanthes, yucca, peanuts and corn gleanings, as well as from consuming cull bananas, other fruit and vegetables. The swine will be kept behind fencing. Possibly electric crossfencing can be used to permit rotation of hogs from one small area to another. For small herds, such as are envisaged, no special farrowing pens should be required.

-Farmer Benefits

Using a model where hogs are farrowed and fattened on the same farm, and assuming that market hogs will be nine months old when they reach a market weight of 100 kilograms, the following cash budget would obtain:

CASH BUDGET - SWINE OPERATION 1/

CAPITAL INVESTMENT:		
6 sows and one boar at $b 1,500 each	$b	10,500
Fence and posts		5,800
TOTAL INITIAL CASH INVESTMENT	$b	16,300
Annual Cash Expenses of Breeding Herd:		
Feed expense (for six sows, one boar and 15 breeders) 1/4 lb daily of concentrate and minerals at $b 262 qq.	$b	2,390
Vaccines and veterinarian		60
Repayment of Principal and Interest ($PMNT = PV\frac{i}{1-(1+r)-m}$) 2/		3,137
TOTAL ANNUAL CASH EXPENSE OF BREEDING HERD	$b	5,587

1/ Cost data furnished by Ken Graber, agricultural economist with the Asociación de Desarrollo Económico Menonita.

2/ Cash investment and interest amortized over a 6 year period.

ANNUAL CASH BUDGET PER MARKET HOG

Cash income per market hog (100 kg. at $b. 18/kg)		$b 1,800
Cash expenses per market hog allocation of breeding herd cash expenses ($b 5,587 divided by 73 Market Hogs)	$b. 78	
Feed for one market hog (1/4 lb of mineral and concentrate daily for seven months at $b 294 qq)	$b 154	
Interest on feed for one market hog($b 154 at 13% for 4 months average)	$b 7	
Total Cash Expenses for Market Hog		$b 239
NET CASH RETURN PER MARKET HOG		$b 1,561

Net returns for the first year's operation (year 2 program) would be 30 market pigs at $b 1,561 which equals $b46,830, minus breeding herd costs ($b 5,587) for a total of $b 41,243.

Net returns in the second and subsequent years would be 60 market pigs at $b 1,561 each which equals $b 93,660, minus breeding herd costs ($b 5,587) for a total of $b 88,073.

In addition, there will be enough pigs per litter to provide replacements for the breeding herd.

-Marketing

It is anticipated that a relatively small number of market hogs will be consumed locally in the Chapare. The bulk of the production will be marketed as live hogs in Cochabamba. Hogs are sold by the pound and no allowance is made for quality discounts.

National market demand projections indicate that all of the swine to be produced during the five years of the activity can readily be absorbed into national or local marketing channels. To the extent that farmers need assistance in penetrating the existing marketing channels, this should be provided by the Area Development Authority. There is excess capacity in the Cochabamba slaughter houses, so it is not anticipated that additional slaughtering facilities will be required in Cochabamba Department for the short term.

3. Citrus Improvement

The purpose of this activity is to renovate the citrus industry, principally oranges, in the Chapare without significantly increasing overall hectarage, by: a) providing improved varieties budded on disease resistant rootstock; b) introducing varieties that will lengthen the harvest season; c) identifying disease, drainage and soils-problems by area, so as not to continue planting on lands not suitable for citrus; d) establishing nurseries in the various production zones; e) introducing the use of legume cover crops for nitrogen fixation and weed control under the trees; f) continuing research, at the La Jota

and Chipiriri stations as well as at the field level, designed to help solve citrus production problems in the Chapare; and g) completing the establishment of plant material gardens at the two stations so as to reduce dependence upon imported germ plasm.

-Scope

This activity is programmed to produce for replacement in existing citrus areas an average of 150,000 budded trees per year for five years. At 204 trees per hectare, this would permit replacement of 3,676 hectares now planted with criolla varieties, or approximately 60% of the total area in citrus. The propagation is scheduled for eight nurseries, one in each micro-zone of the Chapare suitable for citrus. By the end of the project, nursery management, budders and nursery personnel will have been trained. It is anticipated that some of these nurseries will continue to function after the project period as private enterprise.

-Management

There should be one Bolivian agronomist in charge of the citrus program. He will receive guidance from the Tropical Horticulture Advisor. The Bolivian agronomist should be assisted by three technicians, who - under his direction - will be in charge of all tree crops, including the selection of nursery sites and technology to be used. Efforts will be made to involve the sindicatos in site selection,

land procurement for nurseries and implementation planning. Nursery supervisors, budders and laborers should, if possible, come from the area. Supervisors must be responsive to instructions given by the technical staff. Nursery personnel will be paid with funds advanced from the nursery budget of the Research Extension program, to be repaid with the proceeds from plant sales. Other nursery supplies will be funded in the same manner.

-Nursery Operation

The 8 nurseries will produce 750,000 budded trees for sale to farmers during the five-year project period. Since there is a two-year lag from seed planting to budded trees ready for sale the production schedule is as shown below:

Year	Seed	Budded Trees
1	250,000	
2	250,000	
3	250,000	250,000
4		250,000
5		250,000
		750,000

There should be a 20% overplanting of seed to allow for poor germination and poor budding takes. Assuming a production of 31,250 seedlings per year per nursery, the cost estimates for eight

nurseries show that at a sales price of 10 pesos per plant (US$0.50) the nurseries will just about break even. This selling price is considered reasonable and compares favorably with mass produced budded plant material in other countries.

COST OF NURSERY OPERATION

Year 1	Cost in US$ One Nursery	Cost in US$ Eight Nurseries
Tools and Equipment	1,250	10,000
Seed	400	3,200
Watering System	750	6,000
Fertilizer & Pesticides	300	2,400
Labor	1,200	9,600
Other Supplies	400	3,200
	4,300	34,400
Year 2		
Fertilizer and Pesticides	400	3,200
Seed	400	3,200
Labor	2,000	16,000
Other Supplies	1,200	9,600
Budding labor	4,000	32,000
Other supplies	1,000	8,000
	9,000	72,000

Year 3	9,000	72,000
Year 4	9,000	72,000
Year 5	9,000	72,000
Total for all Years	$40,300	US$322,400

NURSERY SALES

Year 3	250,000 plants at US$0.50	125,000
Year 4	250,000 plants at US$0.50	125,000
Year 5	250,000 plants at US$0.50	125,000
		US$375,000

-Benefit to Farmers

Successful implementation of this activity will salvage the deteriorating citrus industry in the Chapare. Better varieties of disease resistant root stock will allow them to attain a favored position in the internal market. By adding legume cover crops in citrus groves the cost of weeding will be reduced and tree growth as well as fruit quality will be better due to the higher fertility level and increase in organic matter. Given the lack of information about yields and marketing variables, it would be adventurous to attempt to quantify farmer benefits.

1. Pineapple

The purpose of this activity is to assist approximately 400 small farmers, over a five year period, to produce and market one half hectare each of the smooth cayen variety of pineapple.

Activity Content

In the initiation of this activity, 200,000 shoots of the smooth cayen variety of pineapple will be imported from Brazil, possibly with the assistance of the Del Valle processing company located in Cochabamba. One possible method of proceeding might be to sell these shoots to 10 growers, selected by their sindicato, and located in micro-zones 7, 8 and 9. These ten farmers, who would be located strategically throughout the three micro-zones in order to facilitate subsequent distribution of the seed, would have to commit themselves to sell shoots to other members of the sindicatos.

Farmers buying seed in successive years would also be required to make the same commitment. Assuming an average of 3 shoots per year for propagation purposes; a unit cost for the initially imported seed of US$0.35; and a selling price of US$0.175 (3.50 pesos) per locally produced shoot, the propagation schedule and direct costs would be as follows:

Year	No. of Farmers	Plants per Farmer	Cost per Shoot	Cost (US$)
1	10	20,000	.35	70,000
2	30	20,000	.175	105,000
3	90	20,000	.175	315,000
4	270	20,000	.175	945,000
TOTAL	400			US$1,435,000

The only cost to the program, of course, would be the initial US$70,000 which would be recovered when the shoots were sold to the participating farmers on credit. The 10 farmers who received the imported plants at US$0.35 each will be able to recover their investment from the sale of shoots at US$0.175 each, since each plant produces an average of 2 shoots per year.

-Technical Requirements

The technology for successful growing pineapples is more exacting than that for many other crops grown in the Chapare. For this reason a full time agronomist wishing to specialize in pineapple should be selected as activity manager. He should, if possible, receive on-the-job training under Sr. Vasquez, who is a large scale pineapple producer in the Chapare. He should further make an observational tour of the principal pineapple areas in Brazil when the pineapple plant material is being procured. He will be responsible for providing planting instructions, assistance in the procurement of

equipment and supplies, cultural practice guidance, and advice on harvesting and marketing. The pineapple technician will receive guidance from the Tropical Horticulture Advisor.

-Farmer Benefits

One half hectare of pineapple has an expected production of 15,000 fruits per harvest, for three separate harvests over a four year time span for a total of 45,000 fruits. Criolla pineapple prices vary between 5 and 8 pesos per unit (US$0.25 to US$0.40) in the Cochabamba market. Since the smooth cayene is much larger, a conservative price of US$.375 each has been assumed. Thus, if there were no losses, one half hectare of pineapple producing 45,000 fruit would have a gross value of US$16,875.

Estimated costs of production (fertilizer, herbicides, labor, etc.) are US$3,100 per year, or a total of US$12,300 over a three year period. Thus, taking into account the value of the crop plus the value of the sale of shoots, the following picture emerges for the first four years of operation:

	US$
Sale or 180,000 shoots (3 per each of 20,000 plants for each of 3 years)	31,500
Sale of fruit	16,875
Gross Sales	48,375
Expenses	12,300
Net Profit over 4 years	36,075
Net Profit per year	9,019

The above financial assumptions are based upon a perfect crop with perfect marketing which is not likely. The Del Valle canning plant has stated a willingness to process production from 200 to 300 hectares of pineapple production. It is not likely that they would pay full market price for the fruit. However, even if gross sales were only one half the amount shown above, pineapple would still be a highly lucrative crop.

5. Pejivalle 1/

This activity is designed to substantially increase the income level of approximately 1,000 small farmers throughout eight of the nine micro-zones of the Chapare by assisting them in the planting, cultivating, harvesting and marketing of one hectare each of pejivalle, primarily for heart of palm. The Del Valle and Dillman processing plants in Cochabamba are prepared to accept an unlimited quantity of this product.

-Activity Content

Seed should be imported from Brazil or Costa Rica for a limited portion of the plantings. The major portion of the seed, however, can be gathered from the wild pejivalle trees growing in the Chapare. Nurseries will be established in conjunction with the eight citrus nurseries and will following the same production and distribution plan, with the difference that the budding operation will not be required.

1/ Sometimes written "pejibaye" known as "peach palm" in English, "Pupunha" in Brazil. Preferred scientific name - Guilielme gasipaes.

-Technical Requirements

One Bolivian agronomist will be responsible for the program. He will receive technical guidance from the Tropical Horticultural Advisor, but should make an observational tour to the pejivalle production centers in Brazil and Costa Rica and at the same time arrange procurement of improved pejivalle seed. The program manager will be in charge of planning and implementing all aspects of the program including marketing arrangements. Nursery operations, however, will be under the direction of the nursery agrónomos.

-Cultural Practices and Targets

A legume cover crop is recommended as ground cover under the pejivalle palms, which should be planted at 2 x 2 meters for a total population of 2,500 trees per hectare. Since the first palms will be planted in year 2 there should be plenty of seed or planting material in all micro-zones. A proposed planting schedule and the cost of plants for 1,000 hectares over five years at the rate of one hectare per farmer is given below. A cost of US$0.10 per plant is assumed.

Year	No. of Hectares	No. of Plants (In thousands)	Cost in US$
1			
2	200	500	50,000
3	300	750	75,000
4	300	750	75,000
5	200	500	50,000
	1,000	2,500	$ 250,000

-Farmer Benefits

At least one shoot of the pejivalle palm can be harvested each 18 months, once the mother tree is established. Assuming that the farmer can begin cutting by the 3rd year after planting and assuming that today's prices (US$0.70 per palm heart) will prevail, he should have a gross income in the third and successive years of US$1,750. Production costs, aside from labor, should be minimal.

6. Animal Production Center

It is proposed to convert the Chipiriri Research Station into an animal production center where a cross breeding program to upgrade criolla cattle for milk production and draft oxen will be continued and expanded. It is also proposed to have the INC buffalo herd transferred to this station so that a training for the yoke, herd improvement and distribution program can be undertaken. (See comments in Chapter III about possible use of the Heifer Project Technique.) Thirdly, the center would be responsible for the continued development and distribution of swine foundation stock. Finally, work with forage crops will continue.

To carry out the above will require some realignment of the personnel of the station and funds for purchase of additional breeding stock. Some limited construction may also be required.

7. Coconuts, Coffee and Spices

The purpose of this activity is to determine the adaptability and economics of production for coconuts, coffee and certain spices in the 9 micro zones of the Chapare and to have available for multiplication germ plasm from those proven to offer good financial returns to small farmers. Spices to be tested aret Black pepper, vanilla, capsicum pepper, cardamon, nutmeg/mace, allspice, cloves and cinnamon. During the five years of this activity, work with these crops will be limited to small plantings at La Jota and Chipirari stations plus small field trials near the eight zonal nurseries.

-Activity Content

Capsicum pepper seed is available in the country. All other plant material will be imported. Arabusta varieties of coffee should be tried. Black pepper and vanilla will be imported as rooted cuttings. Cardamom rhizomes will be brought in. All other spices and coconuts will be grown from imported seed. The USDA technical team on cacao and spices has made ample suggestions concerning seed and plant material sources.

Plant material required and estimated cost is given below.

Species	Seed or Plants	US$ unit cost	US$ Estimated cost
Coconut	1,400	.60	840
Vanilla	1,200	1.00	1,200
Cardamom	1,200	1.00	1,200
Black pepper	2,000	1.00	2,000
Nutmeg/mace	300	.50	150
Allspice	300	.25	75
Cloves	300	.50	150
Cinnamon	300	.50	150
Coffee	2,000	.50	1,000
			$6,765

In general, 10 test plots will be established for each species -- one at La Jota experiment station and one in each of the nine micro regions. Size of test plots to be located on private farms should be approximately 1/10 of a hectare. A cooperating farmer may try more than one species, but not necessarily all of them.

-Technical Requirements

One Bolivian agronomist specializing in tropical agriculture will be the activity manager and will be assisted by the Tropical Horticulture Advisor. In addition, he will need help from short term consultants who will be brought in periodically. Funds will have to be provided for acquiring suitable reference books and other publications.

Observational training in Brazil and Costa Rica should be contemplated. During these trips arrangements can be made to import seed and plant material.

-Farmer Participation

The cost of this activity should be borne by the Research and Extension Program. Cooperating farmers should furnish land and labor. They will receive plant material, technical guidance and marketing assistance. Proceeds from sales go to the farmer. It is anticipated that the products will find a ready in-country market. Elaborate processing is not required for any of the products that will be produced.

D. RESEARCH AND EXTENSION

1. Description of Current Situation

Chaparo has two experimental stations, one in Chipiriri, and the other in La Jota. The Chipiriri station, located in a very humid area, is a research center for forages and livestock. La Jota, near Chimoré, was transferred from the National Institute of Colonization to the Instituto Boliviano de Tecnología Agropecuaria (IBTA) in 1976, and specializes in crops. The annual crops presently under study are rice, corn, soya and beans. Research on perennial crops include citrus, banana, and rubber. Research is also underway on farming systems, the objective being to find out the best way to keep the land under permanent use, through a system of rotation and interplanting which includes legumes.

The La Jota station presently has seven researchers, each of them with a specific expertise, such as a rice, cacao, farming systems, horticulture, citrus, rubber, corn and beans. The Chipiriri station is staffed by 3 agronomists and 1 middle level technician.

There are 6 extensionists whose areas of responsibility are, respectively, Villa Tunari, Chimore, Ivirgarzama, Chipiriri, San Francisco and Isinuta. The Chipiriri, Villa Tunari and Chimoré agents work on general crops of their areas, while those of Ivirgarzama, San Francisco and Isinuta are working primarily with cacao. The extensionists work out of the experiment stations,

where their work and that of the researchers is coordinated. The methods used by extension agents consist of field days and training of groups of farmers through lectures and visits to the stations by the farmers themselves.

2. Scope of Activity and Methodology

The specific activities to be carried out under the research and extension component of the proposed program are described in the preceding section of the report (Chapter V-C). Following the general philosphy advanced earlier regarding program administration, it is recommended that these activities be executed by IBTA pursuant to a series of convenios entered into between the Area Development Authority and that entity. To the extent feasible, it is suggested that a separate convenio be negotiated each year for each activity. These convenios should specify not only what is to be accomplished in a given time period, but also what techniques or methodologies are to be utilized.

As can be seen from Chapter VB, over the 5 year program period, IBTA will be required to simultaneously carry out seven more or less discrete activities, (many of them with several sub-elements), and which will involve dealing with 5,000 to 7,000 acceptors and 10,000 to 14,000 hectares of production if the program is to achieve its targets. The key to success is: (I) using a technique of production activity managers and teams with proper backup support, as

described in Chapter VB; (2) working through the sindicato structure at the field extension agent level; and (3) using mass media communications.

The production activity managers are responsible for program development and for making sure that the extension agents have specific guidelines concerning their role in any given production activity. The latter are the funnel at the sindicato and farmer level through which all production, credit and marketing information must flow. In this connection it is to be noted that the sindicatos elect one of their members to represent them in agricultural matters. That man serves for two years and then is replaced by another man. He is supposed to keep the other members informed of any agriculture developments that may affect the sindicato, or its members. The elected agricultural representative will be requested to serve as a demonstrator of new technology for that sindicato. In this way the extensionist will work directly with one farmer in each sindicato, and indirectly will reach every farmer in his region. The part of the farmer representative in this project should be to act as a field demonstrator for the other farmers in the sindicato. The demonstrations will be performed in his farm. Inputs, e.g., seed, fertilizer, tools, etc., should be furnished by him, although exceptions can be made. He will participate in the evaluation of the demonstration. He will attend training courses and will advise

other members of the sindicato on carrying out similar practices on their farms, if he approves of the innovation.

The mass media facilities (primarily radio) are described and costed in the following chapter, VE.

3. Organization and Staffing

For administrative purposes, it is recommended that IBTA organize its research and extension personnel in the Chapare into four integrated sections, one each for Production, Services, Support and Zonal Agents. The specific requirements and timing of recruitment for each section are as follows (see Table VD-1 for summary):

-Production Section

1 agronomist (year 1) Farming Systems and Legumes

1 agronomist (year 1) Annual Crops

1 agronomist (year 1) Swine

1 veterinarian (year 1) Swine-cattle

1 veterinarian (year 3) Swine-cattle

1 agronomist (year 1) Citrus

1 agronomist (year 1) Pineapple

1 agronomist (year 1) Pejivalle

1 agronomist (year 1) Spices and Tropical Fruits

-Service Section

1 agronomist (year 1) Seed multiplication and distribution

3 mid-level professionals (year 1) Nurseries

1 mid-level professional (year 1) Animal Production

1 mid-level professional (year 2) Animal Training

-Support Section

a) Technical Personnel

1 Agronomist - Program Director (year 1)

1 Agricultural Economist (year 1)

1 Extension/Communications Specialist (year 1)

1 Agronomist-Soils Specialist (year 1)

1 Soils Laboratory Technician (year 1)

b) Administrative Personnel

For each of the La Jota and Chapiriri stations the following administrative staff is suggested:

1 Administrative Assistant

2 Clerk Typists

1 Chauffeur

1 Mechanic

15 laborers

-Zonal Agent Section

Each of the 9 micro regions should have one full time agronomist/extension agent. For the 4 micro zones which have more than 20

sindicatos, the agronomist should have a mid-level professional assistant.

TABLE VD-1

Research and Extension Personnel Requirements
Number of Employees by Year

Professional & Technical	1981	1982	1983	1984	1985
Agronomists	10	10	10	10	10
Veterinarians	1	1	2	2	2
Mid-level technical personnel	4	4	4	4	4
Zonal agents and assistants	13	13	13	13	13
Other Professionals	2	2	2	2	2
	30	30	31	31	31
Support Staff					
Secretary/Typists	4	4	4	4	4
Administrative Assistant	2	2	2	2	2
	6	6	6	6	6
Other Full-time Staff					
Chauffeurs	2	2	2	2	2
Mechanics	2	2	2	2	2
Caretakers	11	11	11	11	11
	15	15	15	15	15
Laborers	30	30	30	30	30

4. Expatriate Advisory Services

The agricultural extension and and research program proposes sweeping changes in the farming system of the Chapare through the introduction of numerous innovations. These activities are new to the farmers of Chapare and to most of the Bolivian agricultural technicians as well.

Foreign advisors will be required for the first four years of the program. They will fill in where technology gaps are greatest, assist in program planning and in the training of Bolivian researchers and extension workers.

On the basis of current Bolivian capacity in research and extension, a six man advisory team, preferably under 1 institutional contract, with the following specialties is recommended:

1 specialist in farming systems

1 specialist in tropical horticulture

1 agronomy/tropical soils specialist

1 specialist in farm management/agricultural economics

1 extension/communications specialist

1 animal production specialist.

In addition, provision should be made for 6 man-months per year of short term consultants.

One of the specialists would serve as team leader, but he would be relieved of many of his administrative duties by a local hire administrative assistant.

Estimated annual costs of the advisory services are shown below in Table VD-2. Total cost of the contract for a four-year period is about $2.6 million, assuming no equipment is purchased under the contract and that local transportation and secretarial help are paid for from the research and extension budget.

TABLE VD-2

Estimated Average Annual Budget for Advisory Team

Long Term Advisors 6 man-years at $90,000 per year for salaries, overhead and allowances		US$ 540,000
Short Term Consultants 6 man-months at $8,000 per month for salaries and overhead		48,000
Travel (international)		9,000
Advisors 6 x 2 RT x $1,000: 4 = 3,000		
Consultants 6 x $1000 RT	6,000	
Per Diem for Consultants 6 man-months at $50/day		9,000
Housing Costs for Advisors 6 advisors x $400/month		28,800
Administrative Costs and Miscellaneous		20,000
AVERAGE ANNUAL COSTS		654,800
TOTAL COST - ADVISORY SERVICE CONTRACT		US$2,619,200

5. In Country Student Studies Program

The advisors from the "International Development Consortium" and Florida State University have been working in cooperation with IBTA to hire Bolivian university students to do studies related to specific development problems. These studies are related to the student's thesis. This has proven to be an economical and reliable tool for research. Also, promising students are identified for future employment by the extension and research program. It is proposed that this activity be continued and that a fund of $b500,000 be set

aside for 10 of these scholarships per year. This will allow for ten studies per year for four years if average duration of field work is three months and an additional three months is required to write up the study.

6. Training of Technical Staff

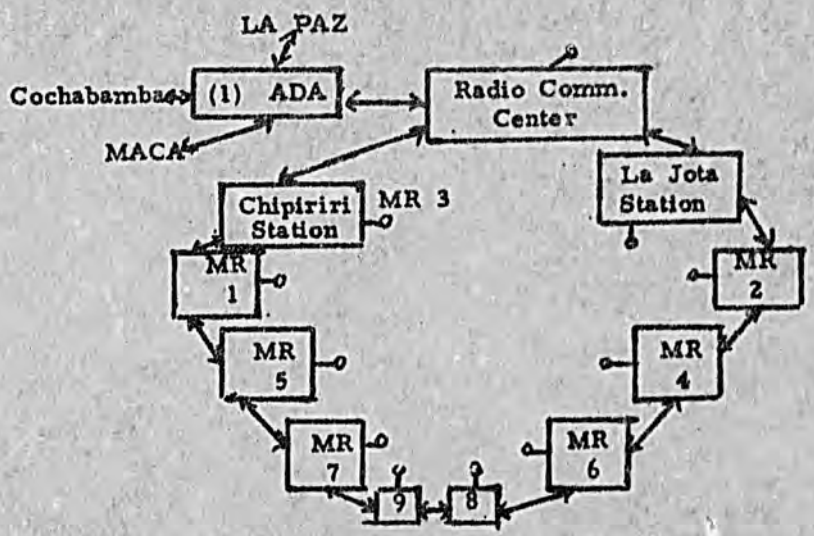
Technical staff should be trained in country whenever possible. If qualified persons in Bolivia can be identified, they should be called on to perform these functions. The training should be carried on in the Chapare whenever possible. Where qualified trainers cannot be identified in country, qualified persons from other countries, preferably from Latin American countries, should be utilized. Also, personnel from the advisory team, both full time and short term consultants should be utilized for this function. Some qualified personnel may be sent to neighboring countries where technology is more advanced for practical training. The training location should be selected for conditions as similar as possible to the Chapare. Assuming three out-of-country practical training trips of 1 month duration each year and four two week in-country seminars each year, other than those conducted by the advisory team, we are including US$20,000 per year in the tentative budget for staff training.

7. Radio Communications Network

To assure better control of the activities, to be able to keep transportation costs to a minimum and for more efficient use of

manpower, it is proposed that a radio communication network be installed. The network will tie the extensionists in the nine micro regions to the two experiment stations and to the ADA headquarters' staff. The communication network will also serve the local communities in emergency situations.

The system proposed calls for 15 transceiver stations. Eleven of these tie the 9 micro-region extension offices to each other, to the Chipiriri and La Jota stations, and to the radio communications center at the Area Development Authority headquarters. (Micro region No. 3 and the Chipiriri station can share one radio) These stations would be equal in power and any one station could communicate directly with any other station. In addition, a 4 station network, on a different wave length, would link the ADA headquarters to Cochabamba, La Paz and MACA. A diagram of the network follows.



PRODES now has in its possession six CA-26A SSB Transceivers which are still in their boxes. These can be used in the system, leaving nine more to be ordered at a cost of US$500 each, or US$13,500 total. To this should be added 15 SST-T2 ultra tuners at US$40 each and installation costs, estimated at US$900, for a grand total for this program component of US$15,000.

8. Other Capital Investment

-Vehicles

Thirteen four-wheel drive pick-ups will be required (one each for the 9 professionals in the Production Section, 1 for the agronomist in the Service Section, and 1 each for the agricultural economist, extension and soils specialists in the Support Section). One of these vehicles will not be required until the second year of the program.

Nine carryalls are programmed (1 for the Bolivian director of the activity, 1 each for the Chipiriri and La Jota stations, and 1 each for the members of the Advisory Team).

The 9 micro-zone extension agents and 3 nursery technicians and other mid-level professional personnel should be provided with heavy duty motorcycles. A total of 17 are estimated as required. Costs are as follows:

		US$
Year 1	Twelve 4 wheel drive pick-ups at $12,660 each	151,920
Year 2	Nine 4 wheel drive carryalls at $14,300 each	128,700
Year 1	Seventeen motorcycles at $1,500 each	25,500
Year 2	One 4 wheel drive pick-up at $13,310	13,310
		319,430

-Agricultural Equipment

One 45 HP farm tractor and accessory equipment are recommended for each of the two stations at a cost of US$60,000. Equipment for the Chipiriri animal training unit will cost about US$2,000 in Year 1 and $1,000 per year in Years 2, 3, 4, and 5. Farming equipment and simple tools for production activities will cost $10,000 in Year 1 and US$500 to $1,000 per year for Years 2, 3, 4 and 5.

-Seed Handling Equipment

A tentative list of the equipment necessary to sort, clean, test and package the various types of seed to be produced and used in the program was prepared by the University of Florida technician. It includes humidity indicators, seed selectors, scales, ventilators, a dehumidifier, a plastic bag sealer, and a refrigeration unit. The approximate cost of this equipment was estimated at US$32,000.

-Buildings

Three types of building construction are envisaged: (a) storage and laboratory space for the seed multiplication activity. A shed type structure, including office space, is estimated to cost approximately US$25,000; (b) housing and office space in each of the nine zonal extension agent headquarters. A two bedroom unit (80 m^2 with kitchen, living/dining room area, office and bath, plus an additional room and bath for overnight visitors is contemplated. A potable water system (well, pipe and elevated tank), a gas or kerosene refrigerator, and basic furniture should also be installed. Total cost per unit is estimated at US$21,350, or US$192,150 for the nine buildings; (c) there will undoubtedly be need for miscellaneous construction on the 2 stations. US$10,000 per year is proposed for this requirement.

-Office Furniture and Equipment

There is considerable IBTA and FRODES material which can be used. A preliminary listing of additional office furniture and equipment required for the 2 stations is as follows:

Number of Units	Item	Unit Cost US$	Total Cost US$
2	Executive Desk	250	500
4	Secretary Desk	200	800
14	Filing Cabinet	200	2,800
2	Executive Chairs	150	300
4	Secretary Chairs	100	400
2	Conference Table	400	800
84	Chairs	50	4,200
	Miscellaneous Office Furniture		5,000
4	Electric Typewriters	1,500	6,000
2	Mimeograph machine	1,750	3,500
2	Calculators (large)	500	1,000
10	Calculators (small)	35	350
	TOTAL		US$ 10,050

9. Revolving Funds

Two revolving funds are contemplated: one for the procurement of germ plasm for each commodity or group of commodities programmed and which will be replenished as seed or plants are sold to farmers; another for livestock.

-Plant Material Requirements

The program costs by year for seed and other plant material destined for sale to farmers is as follows:

	000 US$ Year					
	1	2	3	4	5	Total
Annual and cover crops 1/	4	5	8	-	-	17
Citrus 2/	75	30	-	-	-	105
Pineapple 3/	50	-	-	-	-	50
Pejivalle 2/	50	25	-	-	-	75
Totals	179	60	8	-	-	247

1/ After Year 3 it is expected that farmers will procure their own forage with organizational help from the forage agronomist but with no direct cost to the program. Amounts shown by year above represent new funds required. Repayments plus new funds will allow for increasing supply as the program expands.

2/ Cost shown for citrus and pejivalle is based upon US$.50 per unit for citrus and US$.10 per plant for pejivalle. This includes cost of seed, cost of nursery supplies and equipment and cost of labor. It does not include the cost of the three nursery technicians. By the second program year income from sales should be sufficient to cover costs.

3/ In the case of pineapple, $50,000 will be required for imports the first year. This sum should be reimbursed by the farmers in the first or second year of the program and will serve to cover any shortfalls or lags in repayments for other materials.

-Livestock Requirements

It is assumed that funds will be needed to purchase the first 90 sows and 15 boars required to initiate the swine program. After year one, additional massive purchases should not be necessary and the station at Chipiriri should continue to produce quality breeding stock to inject into the system.

Funds will also be required for the continuation of the cross breeding and upgrading of criolla cattle and for the purchase of breeding stock of either cattle or water buffalo as progress of the animal training center may dictate.

Estimated costs to the program for breeding stock is US$10,000 for swine, all in the first year; and US$20,000 for cattle and buffalo, split between years one and two. By the end of the second year this activity should be largely self supporting as far as direct costs are concerned.

10. Other Costs

Agricultural inputs, such as fertilizer, lime, insecticides, fungicides and herbicides will be needed for demonstration and research activities both at the two stations and in the field. Cost is estimated at US$4,000 per year.

Operation of the vehicle fleet, including tractors is estimated at 20% per year of the acquisition cost of the equipment. This comes to US$75,000 per year.

Genetic material for trials of coconuts, coffee and spices will need to be imported. Cost estimates for this material are US$6,000 in Year one and US$2,000 for each of the following years.

Finally, there are office supplies, repair of office equipment and similar continuing costs. US$1,000 per year is programmed for such items.

TABLE VD-3

RESEARCH AND EXTENSION BUDGET
(000 US$)

	Year One	Year Two	Year Three	Year Four	Year Five	Total
1. Local Personnel Costs 1/						
a. Professional Personnel	270	270	279	279	279	1,377
b. Support Personnel	22	22	22	22	22	110
c. Other Full time staff	41	41	41	41	41	205
d. Day labor	20	20	20	20	20	100
Sub-totals	353	353	362	362	362	1,792
2. Advisory Services Contract 2/	655	655	655	655	-	2,620
3. In-Country Students 3/ Studies Program	6	6	6	6	-	24
4. Technical Staff Training 4/	20	20	20	20	20	100
5. Capital Investment 5/						
a. Radio Comm. Network 6/	15	-	-	-	-	15
b. Vehicles	306	13	-	-	-	319
c. Agricultural Equipment	72	2	2	2	2	80
d. Seed Handling Equipment	32	-	-	-	-	32
e. Building construction	227	10	10	10	10	267
f. Office Furn.& Equipment	11	-	-	-	-	11
Sub-totals	663	25	12	12	12	724
6. Revolving Funds 7/						
a. Plant Material	179	60	8	-	-	247
b. Livestock	20	10	-	-	-	30
Sub-totals	199	70	8	-	-	277
7. Other Costs 8/						
a. Agricultural Inputs	4	4	4	4	4	20
b. Vehicle Oper. & Maint.	75	75	75	75	75	375
c. Genetic Material	6	2	2	2	2	14
d. Office Supplies & Misc.	1	1	1	1	1	5
	86	82	82	82	82	414
8. Totals	1,982	1,211	1,145	1,137	476	5,951
9. 10% Annual Inflation Factor	198	242	344	455	238	1,477
10. GRAND TOTAL	2,180	1,453	1,489	1,592	714	7,428

Notes to Table VD-3

1/ Professional personal costs, including salary, benefits, per diems, etc. are estimated at an average of US$750 per month and covers university graduates, mid-level technical personnel and specialized secondary school learners. On an all inclusive basis, support personnel (clerks, typists, administrative assistants, etc.) are figured at US$300 per month. Other full time staff (janitors, chauffeurs, etc) are budgeted at US$225 per month. Laborers are budgeted at 50 pesos per day. Table VD-1 gives the numbers of persons in each category.

2/ See Table VD-2.

3/ See Section 5 of this Chapter.

4/ See Section 6 of this Chaper.

5/ See Section 8 of this Chapter.

6/ See Section 7 of this Chapter.

7/ See Section 9 of this Chapter.

8/ See Section 10 of this Chapter.

E. COMMUNICATION PROGRAM

1. Introduction

Reaching the Chapare small farmer with improved technologies, production information and other development related material is essentially a communication effort. The communication strategy envisioned involves a multi-channel approach as follows:

(a) Inter-personal, direct contact through extension workers and farmer representatives elected from the Sindicatos. This is discussed in Chapter VD dealing with Research and Extension.

(b) Communication through radio.

(c) Support communication through publications (bulletins, leaflets, etc.) and visual aids.

This proposal only deals with the radio, publications and audio visual aids components of the system(items a and c). These facilities will serve the entire Chapare development effort: agricultural production, education, roads, markets, colonization, cooperatives, etc. All the organizations, government or semi-private, that are involved in the development of the Chapare will be able to use these facilitais. Furthermore, the radio may be utilized as a community service function for passing on messages of a personal nature to the populace.

Given the multi-sectoral nature of the users of the facilities, it is proposed that these facilities be grouped together in a Communications Unit to be administered directly by the Area Development Authority. Aproximately 75 square meters of space should be reserved in the Area Development Authority building for this unit. The unit should be considered as essentially a service facility which is available to meet the needs of the various action

agencies which will be carrying out projects and programs in the Chapare, whether funded under the AID supported program or not.

2. Radio Communication

The proposed system involves linking-up with a presently operating station, such as radio San Rafael[1/] a member of ERISOL (Escuelas Radiofónicas de Bolivia). Involved is the installation of a "repeater" or relay so that its programming will be received in the Chapare. (The programs currently being broadcast by San Rafael are of an educational/development nature). In addition, there will be the capability for open broadcasting in the Chapare from Villa Tunari. This will make possible regional programs of special relevance to Chapare farmers and the rural population in general, e.g. agronomic information, market prices[2/], road conditions, health information, local reunions, etc.

Required to perform the radio communication function is a radio technician located in Villa Tunari. His principal function will be to program, prepare and deliver a one hour daily local broadcast. He will have to be in constant contact with all development agencies working in the Chapare. He should be able to speak Quechua. In order to perform the information gathering and dissemination function at the field level, he will be linked to the extension agencies in each of the nine micro-regions by two-way radio. (See Chapter V D on Research and Extension)

In summary, the radio communication system is as follows:

1/ PRODES has had previous contact with ERBOL regarding radio hookups of a different nature, whereby PRODES would pay for this service. This requires further investigation.

2/ Discussed in Chapter V H on Marketing.

(a) Radio broadcast from ERBOL through a relay "enlace". This is a repetition of the regular broadcasting of an ERBOL Station, perhaps San Rafael in Cochabamba. At present this consists of six hours of programs such as: News (in Quechua and Spanish) nutrition, health, community organization and agriculture.

(b) Open broadcasting from the Chapare of regional programs for no more than one hour daily.

As regards the linkage with an ERBOL Radio Station, an agreement exists between ERBOL and NACA for colaboration in the production of radio programs. This arrangement has not been "exploited" much in the past.

3. Support Communication Through Publications and Visual Aids

This is essentially a Publications Unit with the function of producing bulletins, leaflets and visual aids to support extension and other development efforts. It will also operate a check-out service for audio-visual equipment. Some of this equipment will be available to extensionists and other operational personnel on a simple sign-out basis. Other, more complex equipment, will be made available with an operator.

The Unit would be staffed by a publications technician and two equipment operators. There would also be one secretary, who could be shared with the radio technician. The Unit could either have an artist on its staff or funds for contracting art work.

The basic information (communication) process has been identified as follows[3/]. The publication technician would perform the prepa-

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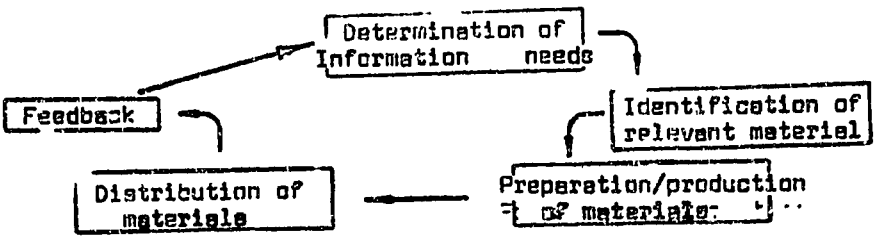
3/ Taken from "Small Farmers Communication Project" University of Missouri Team, IQC No. AID/AFR-C-1139, August, 1979.

ration and production of materials function. In this regard, he will work with research and extension personnel and with technicians from other sector agencies. He will also work in production of training materials.



4. Equipment and Operating Costs

(a) Radio Equipment and Costs

The International Educational Development Agency, from California, sells the following equipment which has been proven appropriate for developing countries.

Transmitter 1 1/2 Kw, high efficiency, 740 Khz.

Antena (Rohn) for 740 Khz.

Antena tuning units.

Ground wire (copperweld) approx. 45,000 ft.

Set of spare tubes and parts

2 Teac tapereorders 2300 S

Spare parts for tapereorder

Audio Mixer Parts A 158

2 Turntables, plus spare parts

4 Microphones

2 Floor stands, 2 desk stands

Kit for folded unipole

vhf system studio transmitter link (Marti transmitter)

Idem receiver

ALL ST DIDEQUIPMENT 1 0/220, automatic

Coaxial cable from transmitter to antenna approx, 200 ft.		
Approx. cost of equipment and installation	US$.	40,000
Relay (short wave 1Kw antenna)	"	15,000
SUB TOTAL	US$.	55,000

(b) Publications Unit, Equipment and Costs

QTY			APPROX. COST
1	Gestetner electric mimeograph	US$.	2,200
1	Stencil maker for duplicating drawings photos, etc+	"	3,000
1	IBM electric typewriter	"	1,100
1	Illuminated drawing table	"	2,000
	Accessories - Leroy drawing set, rulers, squares, etc.	"	1,000
	SUB TOTAL	"	9,300

+ Local prices.

(c) Audio-Visual Equipment for Sign-Out Use

QTY			APPROX. COST
1	Battery-operated slide projector and accessories (Kindermann 12V)	US$.	250.00
1	Battery-operated overhead Projector (Mitchell Art Prod). plus 12V battery 1 amp battery charger, transformer 12V from 220V.	US$.	120.00
1	Projection screen, portable with carrying case (Delite)	US$.	230.00
1	Flip-chart easel and carrying case (Optivox)	US$.	120.00
1	Cassete recorder/player with remote microphone	US$.	100.00

1	35 mm. camera with 45 mm lens + close up attachment	US$.	300.00
1	AV equipment storage cabinet (Bretford Model C40)	US$.	340.00
	TOTAL	US$.	1,350.00
	(4 sets)	US$.	5,400.00

(d) Audio-Visual Equipment to Be Operated by a Communications Unit Technician

QTY			APPROX. COST
2	Electric generators-portable 3,5 Kw 120/240 V,50 cycle	US$.	3,000
2	Voltage transformer-220 to 110	"	200
2	Viewlex Audiovisual 16mm film projectors (Model M16TA - System 16)	"	1,900
	Accessories for above 16mm. projector-cases, extra lamps, etc.	"	100
2	Kodak Ektagraphic Slide Projectors (Model AF-2k)	"	800
2	Kodak Ektagraphic filmstrip adaptors	"	110
2	Dalite projection screens (Model Video A)	"	240
2	Bugl opaque projectors	"	500
1	Cassette recorder/player with built-in Syncronizer (Audio tronics 14015 Sync. Recorder)	"	150
1	35 mm. camera with accessory lenses 45 mm 28mm 185mm. close-up kit, flash, etc.	"	600
	Accessories - extra lamps, slide trays, extension cords, adaptor kits, etc.	"	500

2 Storage cabinets (Bratford C40)	US$.	500
Film, film strip, slide sets, etc.)	"	4,250
SUB TOTAL	US$.	12,850

(e) Vehicles

2 Jeep type vehicles	US$.	25,320
TOTAL EQUIPMENT COSTS	US$.	107,470

(f) Operating Costs

i. Salaries

1 Radio technician	5 years.	US$.	45,000
1 Publication Technician	" "	"	45,000
1 Secretary	" "	"	18,000
2 Equipment operators	" "	"	36,000
SUB TOTAL		US$.	144,000

ii. Repair and Maintenance of Equipment

Vehicle repair, maintenance, gas and oil (50% original cost for 5 year)	US$.	63,300
Maintenance and Repair cost of radio Installation	"	10,000
Maintenance and Repair cost of Audio-Visual Equipment	"	3,400
	US$	76,600

iii. Material & Supplies

Ink, stencils, paper, office supplies, etc	"	50,000

iv. Contracted Artist Service " 25,000

TOTAL OPERATING COSTS	US$.	295,700
GRAND TOTAL	US$.	403,170

F. CREDIT PROGRAM

1. Introduction

This chapter deals only with certain of the credit needs of farmers for the activities described in the proposed program, i.e. those related to the adoption of the recommended new cropping systems and those new crops not promoted by vertically integrated corporations. It is proposed to provide these credit requirements through an expansion and improvement of the services of the Agricultural Credit Bank of Bolivia (BAB) and through the introduction of a network of credit unions (CUs) to be developed by the National Federation of Credit Unions (FINACPE). Such a system has the capability to both mobilize local capital for relending purposes and draw relending capital from the national credit union federation.

The producer credit requirements for the proposed new crops to be promoted via vertically integrated corporations, i.e. tea, cacao and rubber, will be provided by those corporations and will be included in the discussion of the financial requirements of those corporations (See Chapter V B).

The production credit requirements which are dealt with in this chapter include genetic material, technical inputs, capital items and livestock. No credit for labor is contemplated.

2. Determination of Credit Requirements

The production costs, excluding labor, were calculated for each cropping system model and a rate of adoption projected over the 5 year period of the project. The estimated production costs are $ 7.14 million. (See attached table).

To determine the credit requirements, production costs were discounted by 20% for the first three years to take into account: 1) possible double counting in forage planting and forage seed being available in the area after the initial plantings are established; 2) the fact that some farmers will not need credit or do not want to be in debt; 3) that some will be producing their own hogs for fattening instead of using credit to buy from others; and 4) that the adoption rate could be slower than projected.

An objective of this project is to persuade the Chapare farmers to adopt the new cropping systems as a means to better income and a more efficient use of their land. Every attempt will be made to have the farmers adopt the system recommended and not just parts of it. An inducement for them to do so is the readily available credit and technical assistance that this project will provide. While no absolute control in this regard is considered feasable, this "requirement" may affect the rate of adoption and credit flow could be slower than expected.

For the fourth and fifth years, production costs were discounted 30% and 35% respectively to determine credit requirements for those years on the assumption that as the adoption of new cropping systems takes hold in the area and settlers see their advantages, they will use more of their own resources to adopt the practices.

After taking these discounts from the production costs the credit requirements for the new cropping systems is $ 5.07 million. Deducting reflows, the funding requirement for credit is $ 3,921.6 million.

3. Overview of Credit Systems

The Chapare branch of the Banco Agrícola (BAB), will be the principal institution through which credit will be extended in the first year of the project. The credit services via the establishment by FENACRE of a cooperative system of credit unions (CUs) in the key production and population centers of Chapare, will not be operational in any significant way until one year after the start up of the project. Therefore, BAB will be the credit source initially. Most of the recommendations made in this section are directed at the BAB. The CU system of credit already includes most of them.

(Although the Bank of Cochabamba, which maintains a branch office in Villa Tunari, has indicated a willingness to assist

the Chapare development project by using and even expanding its staff and facilities to accept deposits, make disbursements, prepare documents for loans, accounts receivables, etc., it does not want to be responsible for collecting accounts receivable from participating farmers. Thus, the Bank of Cochabamba would not be an appropriate element of the agricultural credit system in the early stages. After the proposed program in underway for a year or two, with more capital flowing into the area from the activities of the vertically integrated corporations and farmers adopting new techniques, the Bank may find advantages in being more active in the project's credit system .

The following types of loans will be made:

- Short term credit. This will be in cash or in-kind for farm inputs for the production of annual crops, and for the purchase of hogs for fattening.
- Medium to long term loans. This will also be in cash or in-kind for on-farm investments, machinery, storage facilities, livestock and the establishment of certain tree crops.

4. General Considerations

Minimum loans should be 3,000 pesos. This is a high cost loan to the lender in any event. Anything less would be a negative contribution to the fixed costs of the lender. Farmers who want to borrow less should be encouraged to participate in a group loan.

loan maximums should not exceed 200,000 pesos since $ 10,000 is the limit BAB/AID have placed on AID's financing of BAB's small farmer credit program.(SFCP).

Interest rates will be those charged by BAB for short, medium and long term loans. The bank's rate is currently 13%. There are no additional charges. Later in the first year of the project as the CUs become operational, CU interest rates will be charged. Currently they range from 12% to 16% plus a 10% capitalization addition to each loan.

The BAB portfolio should minimize the number of accounts. Farmers will only need short and medium term loans to adopt the new cropping system. These loans should be extended as a line of credit with one outstanding balance.

Group loans, e.g. to sindicatos or groups that have formed in the area for special agricultural purposes such as Equipo Chapare, should be used as much as possible with each member being responsible for the amount of the loan. This reduces costs and simplifies procedures for both the lender and the borrower. With line of credit lending for 2 or 3 years based on approved cropping plans the farmers will know at any time what funds are available to them.

Repayment terms should be flexible and take into account the

timing of the farmer's ability to pay. They should allow for unforseeable circumstances such as drought, flood, crop failures.

For short term loans the repayment period should be up to 12 months with consideration being given to when the farmer will have cash flow from the marketing of his products. The farmer should be able to set the date for the final payment.

For longer term loans the grace period would be from one to three years, depending on when production from the investment will occur or be of sufficient volume to start repayment. Amortization of principal may be spread 3 to 5 years following the grace period. Yearly interest payments should be made.

5. Group Loans

A typical group loan might have the following pattern:

a) At a pre-arranged date, established well ahead of planting time by the micro zone extension agent and appointed sindicato leader(s), a meeting will be held with farmers to promote their interest in the new cropping systems by indicating services available: inputs, credit, technical and marketing assistance, etc. Continuing contacts would be maintained with the farmers after this time.

b) Two or three months before planting time the extension agent would develop a list of farmers wanting to adopt the recommended

practices, indicating what the requirements would be case by case. This would include the needs of prior year farmers, if any, who had already started with the systems.

c) The BAB agent with the assistance of the extension agent and sindicato leaders would call a credit approval meeting where loan applications would be reviewed by a credit approval committee. The members of the committee would be the appointed leaders of the sindicato with good knowledge of each of the loan applicants, plus the extension agent and the BAB agent.

d) After agreement as to the creditability of each applicant and the technical soundness of his farm plan, the committee would approve or disapprove the loans in principle.

e) Based on these approvals the BAB agent would set up a group loan account in the approved amount. He would also establish individual accounts where necessary. He would issue cash orders and purchase orders according to the input needs of the approved farm plans. These orders would be used by the individual farmers and/or the loan group leader to obtain cash from the bank for cash requirements and to obtain purchase order items from local merchants or a Farm Input Corporation (FIC) should it become necessary to establish one in order to have proper input supplies in the area for the farmers adopting the new cropping system.

f) When the inputs were delivered to the farmers or group, the local merchants or the FIC agent would take the purchase orders and delivery slips to the bank for collection. The

BAB agent would disburse the funds and debit the individual or the group loan account including the cash disbursements.
g) The BAB agent would visit the farmers during the production period to assure the use of the inputs and cash purchases.
h) Prior to the harvest and the sale of products, the BAB agent would issue a group loan account statement to the group leader, members of the credit committee and the extension agent. The BAB agent with the assistance of the extensionist would establish a time to meet with the farmers to set a date for repayment and to discuss any repayment problems.
i) After the crop sale, the loan group leader would collect from the farmers and deposit the amount at the bank or the BAB agent would come to the sindicato to collect. If there were any outstanding balances, the BAB agent would arrange to collect from the group through the group leader. If the account were not liquidated, no further credit would be extended to any member of the group until the debt was cancelled. The BAB agent would continue to take actions available to him to recover the payment.

Most of these recommendations differ from the methods currently used by BAB. They will need to be reviewed with BAB and/or the technical assistance advisors to be financed by a new AID agricultural credit loan (described below). They will be assisting BAB at national levels in simplifying BAB procedures and improving credit management. Detailing one of the TA

advisors to the Chapare when the project gets underway would be an important means of introducing new procedures into the credit delivery systems of the BAB Chapare branch in the initial stages of the project.

The CUs, if they are set up and operate according to FENACRE standards, will have an effective credit delivery system without need to introduce innovations. They operate at the community level, with their own credit committees, accounting, disbursing and collection facilities.

6. Present Sources of Credit

There are two institutional credit sources in the Chapare: (1) A BAB branch at Villa Tunari with a portfolio of 500 agricultural and livestock loans; $ 0.6 million in loans outstanding, and one employee. Most of the branch's operations are in the Villa Tunari area with almost no service to other Chapare areas; (2) a branch of a private commercial bank, The Bank of Cochabamba, making small construction and commercial type loans, with some lending for agriculture, mainly for labor cost to clear land. This branch has two employees.

Other credit sources exist in the area. There are reportedly some very limited credit flows to small groups of farmers who are being assisted by non-profit, essentially volunteer, external assistance organizations. There are also the informal and quick

sources at notoriously high costs. Estimates range from 5% - 10% per month to 200% per year on small loans. How much of the credit demand is filled by these informal sources such as family, friends, money lenders, store owners, truckers and buyers is not known. However, because the Chapare is a major producer of coca, and most farmers have a small plot, income from this crop reduces the farmer's dependence on institutional credit sources and offsets some of his need to have credit for the production in other crops.

International agencies such as IDB and IBRD have agricultural development programs with credit components but none are applicable to the Chapare. IDB has a team developing project proposals for the Chapare. However, there is nothing in IDB's portfolio that is available for the Chapare at this time.

7. Banco Agrícola (BAB)

BAB is Bolivia's most important source of agriculture credit extending approximately 60% of the agricultural loans of the country's banking system. For a multiplicity of reasons, some administrative, some political, the bank has a long history of financial problems. As recent as early 1979 the BAB had to be recapitalized by the Bolivian Government to avoid bankruptcy. During 1979, and as a result of AID financed studies, the Bank has been going through a reorganization which is designed to move it away from lending mainly to large farmers and towards

using its lending capital for loans to small farmers.

AID has also financed BAB's Small Farmer Credit Program (SFCP). Under this program, the portfolio was approximately US$ 9.7 million in loans to 5,975 small farm families as of mid 1979. The average SFCP loan is $ 1,676.

A new concessional US$ 15 million AID loan for agricultural credit is currently in the approval process and scheduled for implementation in 1980. An additional US$ 2.0 million grant will fund long term technical assistance to strengthen the administration and credit management of BAB and FENACRE. The loan will be to the Government of Bolivia, but the implementation agencies will be BAB, FENACRE, and La Merced Cooperative in Santa Cruz, ($ 10.45 million for relending through BAB's SFCP; $ 3.0 million to FENACRE for expanding it's agricultural production credit program; $ 0.65 million to La Merced, a large multipurpose cooperative in Santa Cruz, for relending as agricultural credit; and $ 0.9 million for short term assistance, training, evaluation and contingencies).

In addition to these dollar funds, the project will also commit US$ 15 million equivalent of counterpart funds from future sales of PL480 Title III Commodities: $ 0.65 million will be for construction and operating costs of those BAB offices starting to handle the SFCP; the remaining $ 14.35

million will be used as further loan capital for the SFCP. The counterpart funds are expected to be generated starting in FY 1982.

The criteria to be used by BAB for sublending under the new AID loan are indicated below. The financial limits are lower than under current lending. To qualify a farmer must meet all of the following conditions:

- Demonstration of potential to achieve a production level beyond family maintenance requirements (usually involving adaptation of a new technique requiring credit for purchase of modern inputs, for significant farm improvements, or to permit the cultivation of larger areas of land).
- The maximum loan for any one farm unit will not exceed $ 10,000 annually for combined operating and investment credit;
- A farm operating unit will be considered outside of the target group when net income from farming operations exceeds $ 2,500 per family.
- No farm with more than 10 hectares of cultivated land (20 hectares in the humid Chaco) will be eligible for credit.
- The principal source of the farm family's income must be agriculture.
- The prospective borrower does not have ready access to

other credit sources under reasonable terms and conditions, and

- Loan repayment ability derives solely from farm income or in combination with seasonal off-farm income.

Some Chapare settlers may not now qualify under these criteria for the use of BAB's SFCP funds due to the sale of coca which in 1978 yielded a net income in excess of $ 1,500 per hectare. Coca prices in 1979 have risen significantly. If this trend continues, more farmers will exceed the income limitations. If coca were eliminated from the income calculation, almost all the settlers would qualify.

In addition, the 10 hectares "land in cultivation limitation" will preclude SFCP credit to some settlers in the directed colonization areas where farm size is 20 hectares. As the new cropping system in the area is adopted, more than 10 hectares may come under cultivation. Other criteria present no problems.

To make the SFCP lines of credit available to the Chapare, it is recommended that the farm size and family income limitations be waived for this region and that the BAB utilize a criteria under which <u>any member of the sindicatos who are part of the colonization structure will be eligible for credit</u>.

8. <u>Expanding BAB's Operations in the Chapare</u>

According to BAB representatives in both Cochabamba and Villa

Tunari, without any consideration of the new cropping systems to be promoted under this project, the number of loan applications handled by the Villa Tunari office could be doubled from 500 to 1000 by the addition of an accountant type employee. Loan volume would increase by $ 0.2 million or up to $ 0.8 million. The new volume would be up only 1/3 because most of the loans would be small and mainly for contract labor to harvest rice. The current portfolio of 500 loans is for larger amounts for clearing and planting.

BAB recognizes the need to provide its services in other Chapare areas and wants to establish 2 more branches, one in Ivirgarzama and the other in San Miguel on the road to San Francisco. BAB states that no funds from the headquarter of BAB in La Paz are available for office expansion purposes, nor are they likely to be in the foreseeable future. Whether or not the PL 480 counterpart has been taken into account is not clear.

A first step to increase the credit services in the Villa Tunari area would be the addition of the accounting employee. The approximate costs, (using BAB provided cost estimates) would be:

Personnel

1 accountant	$ 250/mo.	US$	3000/yr.
Benefits-33% of salary		"	1000 "
Housing		"	1800 "
	SUB TOTAL	US$	5800/yr.

Expenses

Travel		US$	500
Supplies		"	250
Misc.		"	50
	SUB TOTAL		800
	TOTAL	US$	6,600/yr.

A second step would be to add BAB offices in the different population and / or production centers of the Chapare. Although BAB proposes Ivirgarzama and San Miguel as the first two, the final location should be decided by the Area Development Authority in accordance with the proposed program. The approximate costs to open a new BAB branch in the Chapare follows:

Equipment

1 Jeep	$ 13,000	
Office equipment (desks chairs, files, typewriter, calculator, etc.)	$ 4,000	
	17,000	$ 17,000

Personnel			
1 Ingeniero Agrónomo	$ 350/mo.		
1 Accountant	$ 250/mo.		
	600	7200/yr.	
Benefits 33%		2400	
Housing		2600	
	SUB TOTAL	12200	$ 12,200
Expenses			
Office Rent		1800	
Travel		1200	
Fuel and Oil		1300	
Maintenance and repairs		600	
Supplies		1000	
Misc.		500	
	SUB TOTAL	6400	$ 6,400
	TOTAL		$ 35,600/yr.

BAB estimates that from 2 to 3 months is required to set up a new office once funding is available. Since the rate of establishment is fairly rapid, the Area Development Authority and BAB can mutually agree to the timing and location of establishing more offices in the context of their annual Convenios.

9. The National Federation of Credit Unions (FENACRE)

FENACRE, headquarted in Cochabamba with 45 full time employees, started in 1962. It now has 190 affiliated CUs with approximately

13,000 members. FENACRE's CU system has assets of $ 27.0 million of which $ 21.0 million are member savings. The outstanding loan portfolio is $ 40.0 million. 50% of the CUs are classified as rural. Of these, 70 are extending agricultural production credit. 16 CUs recently received $ 0.5 million in loans from FENACRE for relending as production credit.

CU loans to members come from savings and from relending capital provided by FENACRE which in turn receives loans from COLAC (Latin American Credit Union Federation). AID will also be a source of loan capital and technical assistance in 1980.

One of the weaknesses of the CU system in recent years has been its inability to attract savings for combined growth. Instead, the system has relied on external capital for relending purposes. The low growth rate of savings is due to below market rates paid on savings. Further, CU interest rates on loans, 12-16% have been below market rates with insufficient spread to allow market rates on deposits. FENACRE has indicated that it is correcting this imbalance in it's operations by increasing the rates on both dividends and loans. This is a condition of the new AID loan.

FENACRE wants to expand its agricultural production credit program and Chapare is one of its areas of interest. Limited

resources have prevented FENACRE from doing more in the Chapare than give very limited assistance to the formation of the three CUs. One is at Villa Victoria with 80 members, approximately 80,000 pesos in savings and 60,000 pesos in loans outstanding; another is at Nueva Canaon with 103 members, approximately 100,000 pesos in savings and 80,000 pesos in loans outstanding; the third is at Villa Ivirza with 90 members, about 70,000 in savings and 60,000 pesos in loans outstanding.

On request, FENACRE has submitted a proposal for the development of a system of 10 CUs (including the above three) in the Chapare over a 4 year period. Details of the proposal are attached as Annex No. 5. The objectives would be to attract at least 1,000 members per year for a total of 4,000 at the end of 4 years and with 14,000 hectares of the members' land under improved technology resulting from the production credit and assistance services of the CUs. The CUs would draw upon the new cropping systems and other improved production techniques being proposed for Chapare.

FENACRE's proposal calls for a $ 7.8 million loan program to be funded as follows: US$ 3.0 million from external sources such as AID; US$ 2.727 million from reflows; US$ 0.234 million from relendable earned interest; US$ 0.390 million from the capitalization fund; US$ 0.149 million from FENACRE resources; and US$ 1.3 million from member contributions (hand labor).

The US$ 3.0 million external loan would be disbursed as follows, according to the FENACRE proposal: 1st year - $ .8 million; 2nd year - $ .75 million; 3rd year - $ .75 million; 4th year - $ .7 million. At the end of the fourth year the system would have approximately $ 4.0 million in capital with which to continue its growth without further external assistance.

In addition to this relending capital, FENACRE would require grant funds with which to initiate the program and carry it to the point of self- sufficiency sometime after the second year of project. A two year budget for these grant requirements is also part of the FENACRE proposal (Annex No. 5). In summary, the grant proposed is $ 367,000 for the first year to establish an office headquarters, eventually to become FENACRE's Chapare regional office, acquire vehicles and equipment, employ a chief of program, 6 technicians in CU promotion and administration, and a secretary. The grant would cover operating costs which includes support to the CUs while they are in formation and until they are generating sufficient interest income to support themselves.

The second year costs would be $ 240,000 for personnel and operating costs. During the second year an evaluation of progess towards self-sufficiency would be made to determine what additional funds might be needed for the third year.

10. Analysis of the FENACRE and BAB Proposals

BAB apparently has, or will soon have, sufficient capital for relending to take care of the entire producer credit requirement of the proposed program (See attached Table).

Likewise, if the FENACRE proposal were adopted in its entirety, it too would satisfy through its CUs the entire credit requirement of the program, although in this case a new US$ 3 million loan on concessional terms would be required.

We see advantages to using both BAB and FENACRE as vehicles for supplying the credit needs of the proposed program. Competition is healthy. Also, for individual farmers or groups of farmers there may be advantages and attraction for dealing with one or the other source, e.g. lower interest rates on the one hand; a sense of ownership of the facility on the other. We propose a Salomonic solution; namely, to look to BAB and FENACRE to each supply 50% of the credit needs of the program.

As regards BAB, the consequences of such a decision are simple. First, US$ 2 million of the SFCP relending funds should be reserved for use in the Chapare in connection with the new cropping systems proposed in this report. Second, since a branch office staffed with 2 competent employees can handle a portfolio of approximately 1,000 individuals loans with an outstanding balance of US$ 800,000 using current procedures, it is reasonable to assume that four branch offices could handle

both the present credit demands of BAB clients and the needs of approximately 3,000 acceptors of the new systems. These could be scheduled as follows: year one - strengthen the Villa Tunari branch office and open 1 new office; years two and three, open one new branch office in each year. The first year costs of establishing each branch office should be provided to the BAB on a grant basis by the Area Development Authority via a Convenio which would also indicate where the branch office was to be located. 1/ Continuing costs of the BAB offices and their personnel, would be assumed by BAB after the first year. The program costs for this subsidy would come to US$ 149,000.

As concerns FENACRE's relending requirements, it will be recalled that, if one excludes family labor from the equation, they estimate that with an external loan of US$ 3 million they can arrive at a loan portfolio of US$ 6.5 million in 4 to 5 years using reflows, interest income, capitalization funds, etc. This is an approximate ratio of 1:2 between external financing and the farmer loan portfolio. Therefore, if the external loan were reduced from US$ 3 million to US$ 1 million, FENACRE should be able to develop a farmer loan portfolio of approximately US$ 2 million in 4 to 5 years. 2/ This is

1/ The location of BAB branch office and CU offices need to be coordinated so that the credit services of the two systems are available throughout the area and not duplicated in the same micro zones.

2/ There will be demands for credits beyond that needed for the new cropping systems. This can be handled by member savings and borrowings from FENACRE. Members savings are not part of the financing of the loan program as presented by FENACRE.

equivalent to approximately 50% of the US$ 3,921,800 credit requirement for the new cropping systems. It is proposed that the project budget include this US$ 1 million for lending by the Area Development Authority to FENACRE on suitable terms i.e. the same as are contemplated in the new US$ 15 million AID credit loan.

In addition, instead of grant funding the cost of the proposed 10 CUs, the number could be reduced to 5, with a coverage of approximately 2,000 rather than 4,000 farmers. Certain staff and equipment will be the same whether the target is 5 rather than 10 CUs. Taking this into account, it is estimated that the grant requirements could be reduced to US$ 183,500 for the first year and US$ 120,000 for the second year: a total grant by the Area Development Authority of US$ 303,500. 3/

11. Summary of Program Costs

In resume, the costs to the project for the credit component of the program is as follows:

Grant to BAB	US$	149,000
Loan to FENACRE	US$	1,000,000
Grant to FENACRE	US$	303,500
TOTAL	US$	1,452,100

3/ These costs are based on the unit costs and fringe benefits as stated in the FENACRE proposal. They are considerably higher than BAB, MACA or salary levels proposed for the new Area Development Authority. During the process of negotiation it may be possible to substantially reduce this grant amount.

Table No. V F-1

Production Costs (Excluding Labor) for Cropping System and

Credit Funding Requirements(in US$ 1,000)

	YEARS						
	1	2	3	4	5	Total	%
Production Costs							
A. Legume Cover Crop	1.0	3.0	9.0	18.0	18.0	49.0	0.7
B. Swine	9.5	27.5	75.0	145.0	269.0	522.0	7.3
C. Fencing	30.0	112.5	360.0	832.5	1,215.0	2,550.0	35.7
D. Storage Sheds	40.0	120.0	360.0	720.0	720.0	1,960.0	25.5
E. Pineapple	73.0	114.0	342.0	1,026.0	0.0	1,555.0	21.8
F. Pejijabe	1.5	26.2	26.2	25.2	8.2	87.5	1.2
G. Citrus	0.0	54.4	80.0	96.0	96.0	326.4	4.6
H. Cattle and all other	1.5	26.3	26.3	25.3	8.3	87.5	1.3
Total Production Cost Excluding Labor	156.5	483.9	1,278.5	2,888.0	2,330.5	7,137.4	100.0
Credit Requirements							
% of Production Cost 80% 1,2,3, years 70% 4th yr., 65% 5th yr.	125.4	387.1	1,022.8	2,021.6	1,514.8	5,071.7	
Summary of Credit by Type of Loan							
Medium Term -2 -5 years. Fencing Sheds, Palm, Pineapple, cattle and misc.	116.9	319.2	891.6	1,840.3	1,265.9	4,433.9	87.4
Short Term - 1 year Swine, Legume Cover Crop Citrus (replacing old trees)	8.5	67.9	131.2	181.3	248.9	637.8	12.6
							100.0

Table No. V F-1 (continued)

	1	2	3	4	5	Total	%
Reflows							
A. Medium Term - Fencing and Sheds 1 yr. grace, 5 yrs. repay Palm - 2 yr. grace 3 yr. repay Pineapple repay 2nd year	0	0	69	140	552	761	
B. Short Term 100%/year Repayment of each year loan	0	8.5	67.9	131.2	181.3	388.9	
C. Total Reflows	0	8.5	136.9	271.2	733.3	1,149.9	
Credit Funding Requirements	125.4	378.6	885.9	1,750.4	781.5	3,921.8	
(3-4c)							

G. AGRIBUSINESS PROGRAM

Agribusiness is a comprehensive term covering not only agro-industries, those industries which directly process agricultural products, but also those businesses which provide essential farm inputs or services or which are important for the effective operation of a food system.

The situation with regard to agrobusiness now operating in the Chapare and with regard to tea, cacao and rubber has been covered in previous chapters of this report. With respect to current crops, or other new crops or animal activities to be promoted, a number of other potential agro-industries have been reviewed. The only one recommended for inclusion in the program is a plant for the dehydration of platano and yuca for the formula feed industry.

1. Dehydration Plant - Platano/Yuca 1/

Platanos/bananas and yuca are traditional autoconsumption crops. Platanos/bananas are also an important cash crop, ranking fourth in importance in the region. However, farmers are unable to sell substantial quantities of production (estimated to be least 20%) due to lack of market demand and transport to market. The market for yuca is insignificant. The dehydration plant will provide a new market for 11,200 MT annually of small farmer production of the two crops.

1/ Principal Source: "Planta para la Deshidratación de Plátano y Yuca", (Draft) Proyecto Chapare, Estudio para el Desarrollo Integrado, ORA (1979)

No technical assistance is required for production of these crops for industrialization purposes.

The initial market for dehydrated products is the Cochabamba valley manufacturers of formula feeds for the poultry and dairy industries. Corn is currently used as the principal source of carbohydrates required in the rations. Price and availability of corn fluctuates throughout the year; in the past year the price has ranged from $b. 2,070 MT to $b. 3,480 MT.

Manufacturers must sell feeds at fixed prices, and hence must constantly change their formulae to maintain required protein, carbohydrate, mineral and vitamin content, while taking into account raw material availability and costs. They have a strong interest in securing a sure source of carbohydrates to substitute for a portion of the corn currently utilized.

A consumption figure of over 10,000 MT annually of formula feed is confirmed by IMBA, a manufacturer of formula feeds for the poultry industry in Cochabamba. Based upon European practice, a substitution of 20% of the corn with yuca would equal 2,000 MT a year.

PIL estimates that the Cochabamba dairy industry consumes 15,300 MT of corn annually. Yuca could substitute for 30% i.e., 4,500 MT a year. The association of milk producers, APL, may also have additional requirements not taken into account by PIL in making their estimate, but these have not been included in our demand estimates because of possible duplication.

The swine industry also offers a good potential market for the plant, subject to further investigation of the transport cost factor where located outside Cochabamba. Due to time limitations, this market has not been investigated or incorporated in this analysis, but is believed to have substantial promise.

Feed manufacturers will require the products of the proposed plant throughout the year and have indicated an interest in annual purchase contracts providing for delivery of fixed quantities each month. Since platanos and yuca are harvested throughout the year, by entering into annual production contracts with small farmers the plant should be able to make this kind of commitment.

As concerns the interest of the small farmer, it is proposed that he be paid at the current farm gate price for fresh market products, i.e. $b. 32 per chipa for bananas. There is no price data for yuca, since very little is commercialized, but again the same principle should apply. The important factor, of course, is that the farmer would have an assured market.

It is recommended that establishment of this agro-industry should be promoted as a private sector, rather than a combined public-private, corporation. It will not deal with new crops, or ones which are otherwise candidates for promotion on technical assistance under the program; involvement of the Authority in corporate activities would detract from its principal development functions without appreciable increased benefits for the small farmers. But the Authority does have an interest in seeing that the plant is established and program support is recommended.

The proposed plant is designed to produce initially 4,500 MT per year, 75% of the known current Cochabamba market demand, on a one shift basis. At 85% efficiency, the plant will utilize 11,200 MT of raw material per year.

The plant can use either platanos or yuca as a raw material. However, platanos present special technical problems because of a greater tendency to clog up machinery. Somewhat different handling is required during initial processing.

Both platano and yuca should be delivered to the plant within 24 hours of harvest. If delayed, they start to deteriorate, affecting the quality of the dehydrated product. Trucks to move raw material from the farm to the plant are included in this project.

Yuca is delivered to plant storage; conveyed to a washer; then to a peeler to remove the skin which contains cyanide; and through a slicer to the dehydrator. Platanos come from storage; heads are separated manually into single units; stems are cut and discarded; platanos are washed and sliced; then moved to the dehydrator. The dried product is then converted into a flour which is palletized. Pellets are sold either in sacks or in bulk.

The estimated cost of the plant and fixed assets is as follows: 2/

2/ Source: "Planta para la Deshidratación de Plátano y Yuca". OEA, 1979: op. cit.

V G-5

		COST $b. (in ooo's)
(1)	Land	3.8
(2)	Land preparation	3.8
(3)	Civil works	480.0
(4)	Building	723.0
(5)	Machinery Installation	7,060.0
(6)	Office equipment	45.0
(7)	Laboratory equipment	160.0
(8)	Vehicles	1,535.0
(9)	Service shop, scales, etc.	1,080.0
(10)	Miscellaneous	608.0
	Total	$b 11,695.6
		US$ (584,780)

For the financial analysis, Tables V G-1 and V G-2, a capital structure of $b. 14,000,000 is assumed: half represented by shareholder funds and half by a loan from the Authority. The concessional terms of the proposed loan - 3 years grace, repayment in equal annual instalments, and 10% interest - are essential for the establishment of the project.

While the rate of return for most investors would not be attractive (8%% cumulative over the first five years), it is believed that it would be adequate for feed manufacturers who traditionally enjoy a relatively low rate of return. It should be noted that the assumptions underlying this rate of return are extremely conservative, e.g. it is assumed that the raw material cost for yuca will be the same as for bananas -- not necessarily the case. It is also

assumed that it will necessary to pay the full fresh market price for bananas. Consequently, the real rate of return may be considerably higher than what is indicated on Table IV.

Table # C-1

Rehabilitation of Factory and Farm Corporation

5 Year Cash Flow 1/ Sh. (000's)

	1	2	3	4	5	TOTAL
SOURCE OF FUNDS						
(1) Shareholders	7,000					7,000
(2) Loans 2/	7,000					7,000
(3) Sales 3/		8,316	8,316	12,474	16,632	49,738
	14,000	8,316	8,316	12,474	16,632	59,738
APPLICATION OF FUNDS						
(1) Organization Costs	250					250
(2) Fixed assets	11,695					11,695
(3) Operating Costs						
(a) Raw materials 4/		3,416	3,416	5,124	6,832	18,788
(b) Salaries 5/	592	808	808	816	1,240	4,264
(c) Packing 6/		250	250	375	500	1,375
(d) Other 7/	537	1,854	1,854	2,336	2,958	9,539
TOTAL OPER. COSTS	1,129	6,328	6,328	8,751	11,530	34,066
(4) Loan Repayment						
(a) Principal				1,400	1,400	2,800
(b) Interest				700	560	1,260
TOTAL APPLICATION	13,074.6	6,328	6,328	10,851	13,490	50,071
Cash flow						
Annual	925.4	1,988.0	1,988.0	1,623	3,142.0	
Cumulative	925.4	2,913.4	4,901.4	6,524.4	9,666.4	9,666.4

V G-5

Notes to Table V G-1

(1) Derived from "Plants" op. cit.

(2) Terms: 3 year grace period; repayment in 5 equal annual instalments, interest 10%.

(3) Projected quantities:

years 2, 3	4,500 T.M.
year 4	6,750 T.M.
year 5	9,000 T.M.

Price used is the 1976 price for corn, $b. 1,676/MT.

(4) The costs of raw material are assumed to be the current farm price for plantanos/bananas for the fresh market: $b. 32 per chiqui = $b. 305 MT

(5) Administration: Manager, Ing. Agronomo, Bookkeeper, Secretary and a production Manager. Other indirect: mechanic, 3 truck drivers and helpers. Direct cost of labor: one shift, 14 laborers. Assumed that administration and other indirect, but not direct, costs are incurred in the first year.

(6) It is assumed that 50% of plant output will be sacked, the balance sold in bulk. The cost of a sack holding 36 Kg. is $b. 12; it is assumed that each will be used 3 times.

(7) Includes general plant costs, utilities, repair and maintenance, administration costs and insurance

Table V G-2
Dehydration of Fletcher and Tuna Corporation
Profit and Loss
(5 Year Projection)
$k. (in 000's)

INCOME	1	2	3	4	5
A. Sales		8,316	8,316	12,474	16,632
EXPENSES					
A. Operating Costs	1,129	6,328	6,328	8,751	11,530
B. Depr/Amort.		1,113	1,113	1,113	1,113
C. Interest				700	560
TOTAL EXPENSES	1,129	7,441	7,441	10,564	13,203
NET PRE-TAX PROFIT					
A. Annual	(1,129)	875	875	1,910	3,429
B. Cumulative	(1,129)	(254)	621	1,531	5,960
RATE OF RETURN ON SHAREHOLDER INVESTMENT					
A. Annual	(16%)	(13%)	13%	27%	49%
B. Cumulative	(16%)	(3%)	10%	37%	86%

Program implications for the dehydration plant is that the Authority will lean the corporation $b. 7,000,000 (US$ 350,000); terms 3 years grace period, repayment in 5 equal annual instalments, interest 10%. The terms are identical to the loan to vertically integrated corporation for tea and the equity to debt ratio is 1:1.

2. Farm Supply Arrangements

Substantial new demand for commercially supplied farm inputs will be created, directly and indirectly by the recommended development program. An adequate delivery system -public, private or cooperative- does not exist in the Chapare. Cochabamba is the source of the limited farm inputs now used. If the program is to succeed, needed farm inputs must be available to the small farmer when needed on an economic basis.

Demand directly created by the program, and financed by the small farmer credit program, during the five year program will be:

Fence construction materials	US$	2,550,000
Storage shed construction materials	US$	720,000
Tools and equipment	US$	252,000
Chemical inputs (fertilizer, insecticides)	US$	275,000
	US$	3,797,000

In addition the program provides for the establishment and operation of seed and plant nurseries in the Chapare with a demand for off-the shelf equipment and supplies totaling approximately US$ 550,000 during the 5 year period.

The small farmer credit program is designed to meet most of his credit needs until the first harvest of the crop involved. The cost of chemical inputs required by the farmers during the five year period, not covered by the credit program, is approximately US$ 42,000.

Thus the total value of the new Chapare demand for farm inputs during the 5 year program period directly attributable to the program is approximately US$ 4,389,000. To round out the demand picture, the following can be added: inputs presently supplied by Cochabamba; those for farmers desiring to expand their activities in the directions indicated in the program, but who do not participate in the credit program; and the continuing growth in demand after the end of the program period.

Objectives and Considerations: There is a need to ensure a permanent and continuing effective and efficient organizational vehicle to provide required farm inputs for the recommended development program and the growing needs for such inputs as the Chapare develops.

The inputs must be readily available when needed in the Chapare on an economic basis for the small farmer. Adequate inventories must be maintained in the Chapare. The prices must be reasonable and the small farmer (and the credit program) must be protected against unjustified high prices. The organization (s) supplying the inputs must have competent business management and margins adequate to maintain and build the needed effective and efficient organization.

Alternatives which might be considered are: (a) Authority stores, (b) Cooperatives, (c) Private sector organizations, or (4) a combined private-public corporation. These are analyzed below.

Authority Stores: The Authority could establish farm supply stores. From past experience with such an approach, the likelihood of efficient management is low. It would dilute the efforts of the Authority in other areas more directly concerned with its primary development role. The Authority's budget would have to include funding for administration and inventories. Such organization should be able to provide inputs at reasonable prices, but the record is that, without subsidies, prices are no lower than commercial operations and are often higher because of the cost of poor management. Lastly, with the limited life of the program, there is no assurance of the continuing life of the Authority or the "company stores".

Cooperatives: An alternative might be the establishment of cooperatives. The history of cooperatives provides little assurance that effective business management could, or would, be secured, when such entities are created "from the top down". Program funding would be required, as in the first alternative.

Private Sector Organizations: Another possibility would be the establishment of one or more farm supply operations in the Chapare by interested private sector organizations. These would supply not only small farmers but all farmers. This approach would provide experienced and effective business management, require no program funding, assure a permanent and continuing organization for providing present, program and future farm inputs needs of the Chapare. Neither the Authority nor the small farmers would have any ownership interest or representation. The role of the Authority would be promotional only.

The spectre of "ripping off" the small farmer can be raised and it would occur, particularly if one private company were to be granted a "monopoly" position by the Authority with respect to farm inputs financed by the farm credit program. The risk can best be avoided, or at least reduced to acceptable levels, if there is competition between suppliers. The greater the number of independent supply organizations that are established in the Chapare, the better for the small farmer.

Combined Private-Public Corporation: If the Authority is not successful in promoting a purely private sector solution within a reasonable time, it could consider a mixed public/private corporation approach to the problem.

The character and functions of such a farm supply corporation are fundamentally different than those in the vertically integrated corporations. It is a trading organization, buying products from other enterprises, and selling them to farmers. It is not involved with manufacture (production) or processing so only nominal facilities are needed.

However, some general principals utilized in vertically integrated corporations might be utilized.

The corporation would be an entrepreneurial organization and could provide farm inputs to any farmer. It would be organized with an interested private company, or companies, and/or individuals owning 60% and the Authority owning the remaining 40% of the shares. The equity payments would be in cash and would correspond to the capital needed to cover fixed assets and administrative

costs. Other aspects of the vertically integrated corporations would not appear to be appropriate, e.g., the automatic sale of Authority shares to farmers. Also the farm supply corporation, being a trading organization, has no need for loans from the Authority for major facility construction as in the case of the vertically integrated corporations. Neither does it require loans to fund farmer credit programs, since the farm credit component of the proposed activities, in effect, makes cash payment possible. Also, it would be reasonable to expect that supplier credit would be available for inventories.

Even though a mixed public private corporation, with Authority participation, is considered a fall back position, we recommend including funding for the Authority share in such a corporation in the program budget in order to ensure that this vital in-put supply function is covered.

For the purpose of developing the capital requirements of the company and, consequently, the funds required by the Authority for the purchase of its 40% share, the assumptions built into the following set of figures have been used. They are believed to be reasonable, but will have to be analyzed and confirmed during the promotional and organizational phases.

(1) Land and buildings, warehouse and 3 stores, at US$ 25,000 each 3/.	US$	100,000
(2) Office equipment		22,500
(3) Store/warehouse fixtures		22,500
(4) Vehicles		40,000
(5) Cost of organization 3/.		12,500
(6) Miscellaneous		2,500
	US$	200,000
Working capital 4/.		100,000
	US$	300,000
Assume bank loan for 50% of cost of land and buildings.		(50,000)
Total Shareholder Capital Requirements	US$	250,000

The investment required of the private companion would be US$ 150,000 and of the Authority US$ 100,000. The latter is the only program implication.

3/ Derived from estimated costs in OEA Projects; includes estimated costs of feasibility study, professional, and corporate organization costs.

4/ Based on an annual sales volume of US$ 1,000,000; turnover 4 times a year; and needed inventory funding by private companies through terms or purchases.

3. Box and Wood Products Factory

While there is no hard data, it is clear that there are substantial losses of Chapare fruits and other products in the process of commercialization 5/. In part this is due to lack of adequate containers at all stages of the food system. To deal with this problem, it is recommended that a box and wood products factory be established in the Chapare.

The following data illustrates the total potential market in the Chapare for fruit boxes (apple box size, holding approx. 20 Kg. of oranges).

	Annual Production MT	Boxes Required 6/
Citrus (primarily oranges)	98,480	492,400
Papaya	2,515	64,100
TOTAL		556,500

In addition such boxes could be utilized for avocados, tomatoes, peppers and other vegetables. Argentine apples are imported in such boxes and they are currently used for tomatoes, peppers and other crops.

In addition to boxes, the factory has a potential market for other wood products for:

5/ See Section III B-11.

6/ Assuming that each box is utilized 10 times.

(a) Fermentation trays for the 3 tea plants, and 7 cacao plants proposed.

(b) Pallets for 3 tea, 7 cacao, 1 rubber, and 1 dehydration plants; an estimated 200 per year for each, a total of 2,400 pallets a year, when all are operating.

For purposes of analysis, we have assumed that the percentage of the potential orange and papaya box market for which the plant can sell boxes is as follows:

Program Year	Approx. % of Potential	Number Of Boxes
1	-	-
2	20 %	120,000
3	20 %	120,000
4	30 %	180,000
5	40 %	240,000

The assumed selling price for each box is Øb. 20. If each box is used 10 times, this equals Øb. 2 per trip. At a market price of Øb. 35/100 oranges, reduction of losses by 6% will justify utilization of the box. Citrus farm losses are unknown but it is estimated that transport and marketing losses are at least 16%.

The appropriate purchaser of boxes are the "mayoristas" or the truckers, rather than the farmers. Providing sacks for farmer use is a common practice for rice and corn. The truckers' Sindicato has expressed a concern about product losses and an interest in reducing them.

Promotion by the Authority of the establishment of a private sector box and wood product factory is recommended. Financial support by the Authority, preferably via a loan, but on an equity basis if necessary, will probably be required. Other involvement in the corporate activity by the Authority is unwarranted; it is only peripheral to the principal development role of the Authority.

The most likely firms to be interested in the box factory, would be those currently operating sawmills in the Chapare or having wood products interests in Cochabamba. However, the box factory is a separate activity from a sawmill operation; others may be interested.

It is recommended that the factory have an annual production capacity of 120,000 boxes, on a one shift basis 7/. The fixed asset investment cost is estimated to be as shown in the following listing:

	$b. (000's)
Land	-
Buildings	64
Machinery and installation	185
Vehicles	984
Spare parts	28
Office Furn./equipment	25
Miscelaneous	67.8
TOTAL	1,354.8
US$	67,740

7/ Derived from a preliminary analysis of a box and wood products factory in the Chapare, "Proyecto Chapare, Estudio para el Desarrollo Integrado", OEA (1979).

As shown in the following financial analysis, which assumes a concessional loan by the Authority, the payout of the shareholder's investment does not occur until the 5th year. His average rate of return for the 5 years is 27.6%, but is over 100% each year thereafter. Such returns should be adequate to interest a private investor.

Table V G-3
Corporation-Box Factory 5 Year Projected Cash Flow
$b. (000's)

SOURCE OF FUNDS	1	2	3	4	5	TOTAL
(1) Shareholders	1,000					1,000
(2) Loan 1/	1,000					1,000
(3) Sales 2/		2,400	2,400	3,600	4,800	13,200
TOTAL	2,000	2,400	2,400	3,600	4,800	15,200
APPLICATION OF FUNDS						
(1) Organisations Costs 3/	100					100
(2) Fixed Assets	1,354.8					1,354.8
(3) Operating Costs						
(a) Raw materials-wood 4/		796.8	796.8	1,195.2	1,593.6	4,382.4
(b) Nails		80.4	80.4	120.6	160.8	442.2
(c) Salaries and labor 5/	376.2	803.9	803.9	1,016.8	1,607.8	4,608.6
Other 6/	43.5	102.5	102.5	102.5	102.5	453.5
TOTAL OPERATIONAL COSTS	419.7	1,783.6	1,783.6	2,435.1	3,464.7	9,286.7
(4) Loan Repayment						
(a) Principal				200	200	400
(b) Interest				100	80	180
TOTAL APPLICATION	1,874.5	1,783.6	1,783.6	2,735.1	3,735.1	11,921.5
Annual	125.5	616.4	616.4	864.9	1,053.3	-
Cumulative	125.5	741.9	1,358.3	2,223.2	3,278.5	3,278.5

Notes to Table V G-3

(1) From Authority; terms - 3 years grace; repayment in 5 equal annual installments, interest 10%.

(2) For year 2 and 3 operations are on a 1 shift basis; for year 4, a 1 1/2 shift basis; year 5 and therefore, on a 2 shift basis.

(3) Including costs of a feasibility study, professional and corporate organization costs.

(4) Wood price: $b. 2 per board foot; 3.3 Bd. Ft. per bon; using 2nd., 3rd. class and scrap lumber.

(5) Fixed salary costs for manager, mechanic and bookkeeper $b. 376,200 per year; balance variable direct labor cost; includes 65% fringe benefits.

(6) Other - Includes insurance, maintenance and utilities.

Table V G-4

CORPORATION - BOX FACTORY 5 YEAR PROJECTION - P&L

Profit and Loss
$b. (IN 000's)

INCOME	1	2	3	4	5
(1) Sales		2,400	2,400	3,600	4,800
EXPENSES					
(1) Operating Costs	419.7	1,783.6	1,783.6	2,435.1	3,464.7
(2) Deprec. and Amort.	209.7	209.7	209.7	209.7	209.7
(3) Interest				100	80
TOTAL EXPENSES	629.4	1,993.3	1,993.3	2,744.8	3,754.4
NET PRE-TAX PROFIT					
- Annual	(629.4)	406.7	406.7	144.8	1,045.6
- Cumulative	(629.4)	(222.7)	184.0	328.8	1,374.4
Rate of Return on Shareholder Investment					
- Annual	(63%)	41%	41%	14%	105%
- Cumulative	(63%)	(22%)	19%	33%	138%

For the box and wood products factory, the only program implication is the Authority loan for $b. 1,000,000 (US$. 50,000); terms - 3 years grace; repayment in 5 equal annual instalments, interest 10%.

4. Summary

Program implications of the Agribusiness recommendations.

	$b. (000's)	US$
A. Dehydration plant		
Authority loan	7,000	350,000
Terms: 3 years grace, repayment in 5 equal annual instalments, Interest 10%		
B. Farm Supply Corporation		
Authority investment in loan	2,000	100,000
C. Box and Wood Products Factory		
Authority loan	1,000	50,000
Terms: 3 year grace; repayment in 5 equal annual instalments, interest 10%.		
TOTAL	$b. 10,000	US$ 500,000

H. MARKETING PROGRAM

The elements of a modest start on improving the existing marketing system have been incorporated in various sections of this report and have been costed where they occur; consequently no separate marketing budget is provided for.

1. Information Flows

A marketing system cannot function without information flows; in fact, lack of communications between the farmer and the market can lead to disequilibria and market saturation of serious proportions, as was the case with sugar and rice.

It is proposed that current price and other market information of importance to the Chapare farmer be collected by the Cochabamba office of the Area Development Authority and relayed by existing SSB equipment to Villa Tunari for broadcast from there on a regular basis. Lack of information as to the supply and demand situation in the Cochabamba and other markets causes delays at the point of sale which waste both the farmer's produce and the trucker's time. Savings in both areas would generate additional income.

The program costs of the SSB equipment are covered in Chapter I D dealing with research and extension; the program costs of the radio broadcasting equipment are covered in Chapter V E on communications.

2. Reduction of Losses

As has previously been explained, the damage and losses sustained by Chapare produce on-farm, in transit and in the market-place represent a gross waste of valuable merchandise and a serious loss of farm income. The key factors in this situation are two:

a) Transport of by far the largest proportion of Chapare produce is loose in the back of a 9 to 15 - ton truck; the goods are heaved on and dumped off with no regard for damage. To facilitate better handling by both the farmer and the trucker, it is proposed to establish a box factory to provide adequate transport containerage. Presumably the transportistas will be the principal customers of the factory; nevertheless, the reduction in losses from damage or totally insaleable fruit is bound to improve farm income. The program costs are budgeted for under Chapter V G on Agribusiness.

b) Because of faulty communications and lack of coordination, there exists ineficiencies in the supply of transport to the Chapare which could be minimized with benefit to both farmers and truckers. The Federación de Transportistas del Chapare which is based in Cochabamba, is proposing to open an office in Villa Tunari so as to improve scheduling of loads and to guarantee that trucks will be on hand to meet the farmers' needs. If this takes place, a considerable reduction in on-farm spoilage could be expected. If some initial financial impetus were necessary to get this scheme started, the Area Development Authority could provide support

from the impact project fund already budgeted for under Chapter IV (see Table IV-34 in that Chapter).

3. The Vertically Integrated Corporations

This report proposes the establishment of three vertically integrated corporations to provide extension services, technical assistance and processing facilities for three crops relatively new to the Chapare, at least on a commercial scale, namely tea, cacao and rubber. All three crops offer excellent farm income possibilities, export opportunities, and in the case of tea and rubber, import substitution. The production and marketing of these crops will be managed in each case as a business enterprise with a view to maximizing farm income consistent with sound commercial practice.

4. Feasibility Studies

The Area Development Authority has a substantial budget for feasibility studies (see Table IV-34, Chapter IV). An obvious candidate would be large-scale export of bananas to Argentina, which is already being done successfully but on a minuscule scale. The Argentine market for pineapples should also be investigated.

5. Technical Personnel

The staff of the Area Development Authority is to include permanent personnel and advisors in the fields of marketing

and business development so as to ensure that appropriate action can be taken in good time to exploit new opportunities as they arise (see Table IV-2 and IV-4 in Chapter IV).

I. AREA TRANSPORTATION SYSTEM

There are basically three components to the road network in the Chapare:

a) The National Highway (Route No. 7) which is paved from Cochabamba to Villa Tunari to Chimoré and which continues on to Puerto Villarroel with a dirt surface. This road is projectec to develop a branch which, starting from Ivirgarzama, will connect with a road coming up from Santa Cruz.

Route Number 7 has another branch which runs north west from Villa Tunari and which is intended to eventually reach Trinidad, the capital of the Beni Department. It is constructed to national highway specifications (but not paved) as far as the Samuzabeti river (35 Km. from Villa Tunari) where a bridge is under construction. All the necessary works of art between Villa Tunari and the Samuzabeti river are in place. The road bed is finished between the Samuzabeti river and Isiboro, but the works of art on this section are not yet in place.

b) The internal collector and connector roads within the settled area of the Chapare. These are mostly low class, dry season roads which have been constructed from mid 1920s to the present and are identified by the Servicio Nacional de Caminos (SNC) as a network which should be improved and maintained. The total length of this network is variously estimated as 260 to

279 kilometers. The distinction between collector and connector roads is simply that the former have junctions with the national highway system, while the latter connect with the collector roads.

c) A series of trails and rudimentary roads -length unknown- which connect individual farms with the roads defined in "b" above.

The universe with which the proposed program is dealing is limited to the collector and connector roads as defined above. These roads were constructed by various GOB entities and individuals without regard to standards, serviceability or maintenance costs. Maintenance of roads constructed in this manner is almost impossible, because most of the roads were constructed at or below the grade of abuting lands and without proper drainage. Such practice permits overflow and/or ponding of water upon the roadway surface which causes rapid deterioration of the road and renders the facility impassable.

At present most of these interior roads are in an advanced state of disrepair and the cause of continued anxiety among the farmers. A study by Ing. Gandolfo of the MACA/CORDECO/INC-OAS Chapare Project team, still in draft, provides as much data as is available on the carrying capacity, vehicular flow, ton/miles etc. for these roads. However, as Ing. Gandolfo indicates,

the data is generally considered unreliable and incomplete. It is thus not an adequate basis for planning.

The objective of the proposed program is to reconstruct and up-grade this 260 kilometer network into an all weather system which can easily be maintained. It is recognized that this will still leave an unknown number of farmers without easy access to all weather roads. (The data for ascertaining the number of farmers who will be left more than 1 kilometer from the proposed all weather network is simply not available). However, as a matter of priorities and of "first things first", it seemed to us that the effort in the five year program period should be concentrated on the major network and, perhaps more importantly, that such an effort would tax the resources of the SNC to the full.

Steps need to be taken to provide farmers who are not located on the all weather road system, with the means of bringing their produce from the farm to the all weather road. In this connection, we are proposing a modest beginning by recommending the conversion of the Chipiriri research station into an animal production center which will, inter alia, produce and train for sale, oxen and buffalo to the yoke. (See Chapter V C). Eventually, wheel tractors will probably be required for this function, but we believe it premature to develop a specific activity to this end at this time. If farmer incomes increase

as a result of the program, some sindicatos and/or individual farmers will acquire such machinery on their own.

1. Up-Grading Existing Roads

As indicated above, the objective is to up-grade the existing road network into a permanent type, all weather, gravel surface road system. Using the 260 kilometers as the universe, this is to be accomplished as follows:

a) The Caminos Vecinas Division of SNC has, or is in the process of reconstructing and /or upgrading 65 kilometers of the system in three areas (Route No. 7 - Tablas Monte; Ivirgarzama - Valle Ivirza; and Camino 4715 - Route No, 7 to El Camino).

b) With regard to Route No. 4791 (Paraíso - Todos Santos), because of the meandering of the Chapare River, 17 Km. of this road should not be up-graded, but maintained as is, to serve the small number of inhabitants in this area. This section to be maintained is located between station 4 Km. east of Paraiso and station 7 km. west of Todos Santos.

c) This leaves 178 kilometers of road to be up-graded under the proposed project. It is recommended that two classes of roads form this up-grading program:

1. The principal collector roads in the densely populated and productive areas should be of one standard and,

2. The connecting roads to the collector roads should be of a slightly lower standard. Both classes will have H-10 Load-capacity (9000 lb. axle load).

The two classes of road to be up-graded break down into 17 segments as follows:

SECTORS OF COLLECTOR (PENETRATION) ROADS TO BE UP-GRADED:

Route No.	Kms.	Cost per Km.	Sub Total Cost
4571	6	US$ 27,073	US$ 162,439
4701	9	"	243,593
4715	4	"	108,293
4777	28	"	758,050
4779	17	"	460,245
4782	4	"	108,293
	68		US$ 1,840,913

SECTORS OF CONNECTOR (LATERAL) ROADS TO BE UP-GRADED: 1/

Route No.	Length Kms.	Cost per Km.	Total Cost
4557	9	US$ 23,372	US$ 210,348
4701	9	"	210,348
4702	4	"	93,488
4703	9	"	210,348
4704	6	"	140,232
4707	14	"	327,208
4765	6	"	140,232
4769	8	"	186,976
4775	15	"	350,580
4773	17	"	397,324
4791	13 (2 segments)	"	303,836
	110		US$ 2,570,920

The above costs ($ 4,411,833) for the two types of road include equipment operation costs. When engineering and administration costs, estimated at 3% and 15% respectively, are added, the total cost of this component of the program comes to $ 5,205,962.

1/ NOTE: This listing, prepared by the MASI team expert, shows 41 Kms. less than the requirement in Ing. Gandalfo's report which was not available at the time these numbers were prepared. The two sets of recommendations should be reconciled.

The design standards will be those of the National Highway Department of Bolivia, which conform substantially to those of the American Association of Highway and Transportation Officials, modified for adaptability to the Chapare Area because of the heavy rainfall and the unusual practice of trucks parking upon the roadway for loading produce.

Pursuant to the above, suggested design standards for up-grading the existing roads within the Chapare area as follows:

- Collector or Penetration Roads

This standard will apply for up-grading collector roads to first class all-gravel surfaced roads, and shall have a designed life of 20 years, and H-10 load capacity (9000# axle load) with a surface life of 5 years, at which time an asphalt surface will be required if the present rate of traffic biuld-up continues. Bridges, box-culverts and pipe culverts will have a designed life of 30 years and H-15 load capacity. Fords will have a designed life of 10 years; replacement with bridges should be considered after 5 years if traffic build up so requires.

Platform width	10 meters
Roadway surface	6.2 mts.
Bridges, (width)	6.2 mts.
Culverts (width)	6.2 mts.
Fords (width)	6.2 mts.

Platforms are to be raised to at least 60 cm. above buting lands. Sub base courses will be 20 cm. of screened natural river gravel. The base course will be 15 cm. of screened river gravel. The wearing surface will be 10 cm. of screened natural river gravel of dense gradation.

-Lateral or Connecting Roads

Design standards applicable to these roads will be those required for up-grading to second class all-weather gravel surfaced roads. The design applicable to first class gravel roads will govern for second class, except for roadway widths, as follows:

Platform width	8 meters
Roadway surface width	4.5 meters
Bridges (width)	6.2 meters
Culverts (width)	6.2 meters
Fords (width)	6.2 meters

Roads constructed to these standards are considered adequate for the type and volume of present and projected traffic and will provide all-weather access to the Bolivian National Highway network. The design criteria suggested is based on economic benefits, in lieu of average daily and projected traffic volumes.

The work to be performed includes, but is not limited to re-clearing and grubbing, widening of roadway platforms, reinforcing and stabilizing the sub-grade. Construction of sub-base courses and the placing of selected and screened surfacing aggregates, installation of pipe culverts, box culverts and construction of bridges and fords is also contemplated.

- Procedures

Clearing and Grubbing: Prior to starting any grading operations, all vegetation, roots and other debris shall be cleared and removed from the work area.

Grade Raising The existing roadway platform shall be scarified and sufficient moisture added to assure bonding of the existing surface materials and the new materials to be added. The platform must then be widened to 8 to 10 meters as the case may be. Side ditches will be excavated and platforms raised to at least 60 cm. above abuting lands and compacted as required; culverts should be installed prior to the placing of base and sub-base courses. During the construction of the roadway platform, the surface should be maintained in such condition that it will be drained at all times without serious erosion.

The sub-base course shall be 20 cm. of screened natural river gravel with a gradation of 3" minus, and compacted to 95% of maximum density. The base course shall then be placed, using the same type

material, with a depth of 15 cm. and compacted to 95% of maximum density.

The wearing surface shall then be placed, using 10 cm. of screened natural river gravel with a dense graded aggregate of 1" minus and compacted to 95 to 100% of maximum density. This type of roadway surface will provide a dense and smooth riding surface with a minimum amount of maintenance attention.

- Ferries, Fords and Bridges

Within the 178 kilometers to be up-graded, there will be a need to construct 5 bridges at 10 meter widths, with an aggregate length of 52 meters at the following locations:

Route No. 4571	10 mts.
Route No. 4784	10 mts.
Route No. 4779	10 mts.
Route No. 4782	12 mts.
Route No. 4782	10 mts.

At a cost of linear meter of US$ 7,064 this comes to US$ 367,328. To this must be added 10% (US$ 36,732) for engineering and design costs, plus 3% (US$ 11,010) for inspection costs. Thus the total cost for the bridges is US$ 415,070.

Two ferries will also be required for crossing the Chapare river on Routes 4715 and 4791. SNC states that they have 2 barges that

will serve for this purpose. However, cables, pulleys, engines and other supporting equipment plus installation costs will be required. This is estimated at US$ 42,000. EPC should operate these ferries and charge a crossing tariff sufficient to cover operational costs.

The design also calls for construction of 5 fords, averaging 6.2 meters in width by 10 meters in length for a total of 310 m^2. These are estimated at US$ 35.15 per m^2 for a total construction cost of US$ 10,866. When engineering and design costs (10%) and inspection costs (3%) are added, the total cost for the 5 fords comes to US$ 12,279.

- Culverts

The project calls for the construction and installation of 2 types of culverts:

a) 14 box culverts of which six will be 1 x 3 meters x 6.2 meters in length plus 8 which will be 1 x 3 meters x 4.5 meters in length. At a unit cost of US$ 93.25 per square meter, plus engineering, design and inspection costs, the total requirement for this item is US$ 54,878.

b) 3,858 linear meters of reinforced concrete pipe of 1 meter in diameter. (The pipe now being installed by Caminos Vecinales

on road No. 4715 is too small (60 cm. in diameter) to permit an adequate flow capacity during flooding conditions. It is also difficult to clean.) It is estimated that the fabrication and installation cost of 1 meter diameter pipe is as follows:

Fabrication of each unit	US$ 45.55
Installation of each unit	US$ 18.75
Total	US$ 64.30

For 3,858 linear meters, the total cost for this item comes to US$ 248,069.

- Equipment Requirements

Equipment necessary to up-grade 178 kms. of existing roads, fabrication and installation of culvert pipe and fords and the production of required aggregates are tabulated below. Equipment requirements for new road construction (see section 2 below) is not included.

The equipment should be operated by SNC under annual Convenios with the Area Development Authority, which should specify what roads are to be worked on in a given year. The Convenios should also specify that the equipment is not to be moved from the Chapare without the specific authorization of the Authority.

TABLE NO. V 1-1

List of Proposed Equipment

TYPE	CAPACITY	QUANTITY	UNIT COST		TOTAL COST
Pick-up Trucks	3/4 Ton.	3	$ 9,000	Est.	$ 27,000
Stake body Trucks	2-2½ Ton.	2	17,800	"	$ 35,600
Dump body Trucks	5 Cu. mtr.	15	17,910	"	$ 268,650
Lube/shop Trucks	3-3½ Ton.	1	23,500	"	$ 23,500
Water-Tank Trucks	1800 Gal.	3	21,300	"	$ 63,900
Fuel-Tank Trucks	1800 Gal.	1	21,300	"	$ 21,300
Tractor/dozer	D-8 Class-Cat.	3	83,100	"	$ 249,300
Tractor/dozer	D-7 Class-Cat.	2	87,250	"	$ 174,500
Motorgrader	Model 120-Cat.	3	64,300	"	$ 192,900
Front Loader	Model 950 Cat.	3	62,150	"	$ 186,450
Roller	3/wheel-10-12-Ton.	1	23,000	"	$ 23,000
Roller	2/Drum-Tandem 5-Ton.	1	18,000	"	$ 18,000
Roller	Pneumatic 8-10 Ton.	2	26,000	"	$ 52,000
Roller	Vibrator - 48" 5-7 Ton.	1	21,000	"	$ 21,000
Separation Screening Plants		40 TpH 1	46,000	"	$ 92,000
Belt conveyors (Self Powered)		40 TpH 2	8,200	"	$ 16,400
Concrete mixer (4-Sack)		40 TpH 1	13,200	"	$ 13,200
Concrete Pipe Forms (Set)		40 TpH 1	2,100	"	$ 2,100
Tilt Trailer	20-22 Ton.	40 TpH 2	9,000	"	$ 18,000
			Sub-Total		$ 1,498,800
Spare Parts	10%				149,880
			TOTAL		$ 1,648,680

-Planning of Work

There are no formidable obstacles to betterment and reconstruction except periods of intense rainfall. Water courses to be bridged are small to medium, except rivers to be crossed by ferry.

Excavations will not involve large quantities of work. Suitable stone, gravel and other granular materials for construction are readily available throughout Chapare.

Prudence must be exercised in planning for the successfull execution of this betterment project. Planning should be so closely controlled that construction and/or equipment use may proceed at least 80% of the year. With proper planning, clearing and grubbing, construction of roadway platforms, concrete culvert pipe fabrication and production of construction aggregates may be accomplished during the dry season. Hauling, placing and spreading of aggregates, installation of culverts and construction of fords and bridges can continue during the rainy season; except during downpours, which should not be more than 25% of the rainy season. This procedure often expedites and reduces compaction costs for required densities of in place aggregates, by taking advantages

of rainfall for moisture-density requirements in lieu of hauling water for this purpose.

The most expedient and economic manner of accomplishing this project is to closely adhere to simple and standard methods such as:

1. Roadside barrow must be utilized for raising existing platform grades.
2. Use of native materials abundant in most rivers throughout the Chapare.
3. Use of local farm labor during periods when farming does not demand his attention.

The Convenios between the Area Development Authority and SNC should cover work methods to be employed.

2. New Road Construction

We are projecting a requirement for construction of 10 kilometers of new collector and/or connector roads each year, for a total of 50 km. during the life of the project. This estimate derives from a calculation as to the rate of new immigration into the area as a percentage of the present number of colonists related to the current number of kilometers of road in the system. This is, at best, a very crude estimate. The location for the new roads to be

constructed should be governed by colonization build-up in specific micro regions and should be determined yearly by the Area Development Authority.

Included in this 50 km. estimate is a requirement to reconstruct route No. 4776 from the station 7 kms. west of Todos Santos on route No. 4791 so as to connect with route 4779, a distance of 6 kms. This will permit access to the Todos Santos area in replacement of the 17 kilometers of 4791 that, as indicated early, is not recommended for upgrading due to the meanderings of the Chapare river.

The specifications for the new roads are the same as those described under road reconstruction.

The unit cost of the new roads construction is estimated at US$ 30,100 per kilometer. To this should be added 3% for engineering costs and 15% for administration costs. Thus the total cost of the construction is US$ 1,775,590.

In addition, we estimate that 1200 meters of one meter diameter pipe culverts will be required on the new road construction at a unit cost of US$ 64.30 for a total of US$ 77,160, bringing the overall total for new road construction to US$ 1,852,750.

It will be noted that no new equipment for new road construction is included in the cost of this element of the program. The reason is that the equipment recently provided by AID to Caminos Vecinales, and which has been working part of the year in the Chapare, is ample to take care of this 10 kilometers per year projected need with perhaps two months per year operation.

The annual convenios between the Area Development Authority and the SNC, under which operating costs for new roads will be covered, should specify that the equipment in question will be made available in the Chapare for precisely specified periods of time.

3. Road Maintenance

For both up-graded and newly constructed roads, regular maintenance will be required as the betterment and construction is completed [3/]. The schedule on which this should take place and the yearly costs, over the 5 year life of project, are indicated below. The yearly schedule assumes a rate of completion of 45.6 kilometers per year between new and up-graded roads. The cost per kilometer is based on the average in the Cochabamba district for gravel surfaced roads and includes

3/ Details on specifications for maintenance work are contained in the draft report by Ing. Gandulfo referred to earlier.

administrative and other costs.

	Kms.	Cost per Km.	Annual Cost
1st year	45.6	US$ 960	US$ 43,776
2nd year	91.2	"	87,552
3rd year	136.8	"	131,328
4th year	182.4	"	175,104
5th year	228.0	"	218,880
		Total	US$ 675,416

Again it will be noted that no provision is made for adquisition of new equipment, even though the machinery presently in use in the Chapare is old and inadequate. The reason is our understanding that the IDB is making available US$ 25 million to SNC for adquisition of road maintenance equipment for use nationally.

As a quid pro quo for the purchase of the equipment listed in Section 2 above for road upgrading purposes, the Convenio between the Area Development Authority and the SNC should commit the latter to place and maintain year round in the Chapare, the equipment necessary to perform the maintenance function, with it being removed only with the concurrence of the Authority.

We have not attempted to detail the specific items, but they also should be specified in the Convenio.

4. Program Administration

As is indicated earlier, it is recommended that the various elements of this program be implemented pursuant to annual Convenios between the Area Development Authority and the SNC. The functions which the SNC should perform pursuant to these Convenios should include:

Administration

Execution of Construction

Engineering and Design

Supervision and Inspection

Testing and Quality Control

Equipment Operation and Control

Equipment Maintenance and Records

Progress and Problem Reporting

Cost Accounting and Records

SNC maintenance forces should accomplish by force account all phases of the road betterment project, except bridges and box culverts which should be constructed by contract. With regard to these latter, the SNC Engineering and Design Section should design the

bridges and box culverts, develop construction plans and specifications, unit quantities and bid documents, as well as field location and staking necessary for construction. The same procedure should apply to new road construction, except that the Caminos Vecinales unit should carry out the work.

SNC forces should fabricate, locate in the field, as required, and install all concrete pipe culverts and construct all fords, and ferry installations.

5. Summary of Project Costs

The following data is in current prices:

1. Operational cost of Upgrading of existing roads	US$	5,205,962
2. Bridges		415,070
3. Ferries		42,000
4. Fords		12,279
5. Box Culverts		54,878
6. Pipe culverts		248,069
7. Equipment		1,648,680
Sub Total for Upgrading	US$	7,626,938
8. Operational Cost of new road Construction	US$	1,852,750
9. Operational Cost of Road Maintenance	US$	675,416
TOTAL COST	US$	10,155,104

When the financial requirements are disaggregated on a yearly basis, assuming 1981 is year one, and a 10% annual inflation factor is included, the following picture emerges:

(in thousands of US$)

	Year 1	Year 2	Year 3	Year 4	Year 5
1. Operational Cost of Upgrading Existing Roads	1,041.2	1,041.2	1,041.2	1,041.2	1,041.2
2. Bridges	207.5	207.5	-	-	-
3. Ferries	42.0	-	-	-	-
4. Fords	6.1	6.1	-	-	-
5. Box Culverts	11.0	11.0	11.0	11.0	11.0
6. Pipe Culverts	49.6	49.6	49.6	49.6	49.6
7. Equipment	1,648.7	-	-	-	-
8. Operational Cost of New Road Construct.	370.6	370.6	370.6	370.6	370.6
9. Operational Cost of Road Maintenance	43.8	87.6	131.3	175.1	218.9
Sub Totals	3,420.5	1,773.6	1,603.7	1,647.5	1,691.3
10. 10% Annual Inflation factor on Incremental basis	342.0	354.7	481.1	659.0	846.7
Totals	3,762.5	2,128.3	2,084.8	2,306.5	2,538.0

The total for the five years, using this method of calculation, comes to US$ 12.8 million.

J. ELECTRICITY AND POTABLE WATER PROGRAM

1. General Considerations and Objectives

A major reason for dealing with village level electrification and potable water systems together is that, from the standpoint of this report, both are viewed as means to a common end; i.e. as steps towards increasing the nucleation of the population into the potential growth poles indicated for each of the 9 micro-regions. In addition, because of topography, it is likely that most potable water systems installed in Chapare growth poles will not be able to use gravity flow techniques and, instead, will require pumping installations which, in turn, means electricity.

-Source Material

In dealing with the subject matter of this Chapter we attempted to reconcile the findings and recommendations of several discrete reports, as modified by conversations with the people and entities responsible for their preparation. The reports were as follows:

i. A MACA-INC-CORDECO/OEA Sanitation Project Proposal[1/] for construction of 9 potable water systems and for sanitary latrines installation in an unspecified number of housing units;

ii. A MACA-INC-CORDECO/OEA Electrification Project Proposal[2/] for installing diesel generating equipment in 11 population centers, and which was based on an assumption that hydro-electric power would not be available in the Chapare for a minimum of 5 years. (See Annex 6 for further details)

1/ Ricaldez, Juan Carlos; Guzman, Hugo and Bacigalupe, Javier: "Proyecto Chapare, Estudio para el Desarollo Integrado: MACA-INC-CORDECO/OEA; Sub Programa de Saneamiento", (Draft version), 1979

2/ Catacha Ellis, Walter and Villanueva, Jose: "Proyecto de Pre Factibilidad para la Electrificacion de Centros Poblados del Chapare (1a Etapa), 1979, (draft version)

iii. A communication from the Cochabamba Light and Power Company (ELFIC)[3/] which advised that together with the National Electricity Generating Company (ENDE), they were presenting a loan application to the IDB, for consideration by the Board of Governors of the Bank in December, 1979 and, under which -- if approved -- ENDE expected to construct a sub-transmission circuit from the Corani hydroelectric plant to Villa Tunari in the Chapare and ELFIC, in two stages, would install electrical distribution systems in 22 population centers. (See Annex no. 7 for further details on the ENDE/ELFIC plans.)

iv. An AID Project Paper[4/] which provided funding for a national program of rural sanitation programs, including the Chapare.

-Assumptions

We are proceeding on the assumption that the IDB Loan will be approved in December, 1979. If this proves not to be the case, not only this program activity, but the costs of the various agro-industries dealt with in Chapters V B and G, and possible other activities, e.g. the costs of installing extension agents in each of the micro-regions, may have to be rethought. In none of these instances have we included individual electricity generating equipment.

Since the electrification network is scheduled to be installed in two stages, we have also assumed that: (a) with few exceptions, it will be politically feasable for those growth poles scheduled for installation of potable water systems, but which are not sche-

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3/ Villanueva, Jose: Memorandum dated 28/9/79, entitled "Proyecto de Electrificacion del Chapare, as modified by conversations with the General Manager of ELFIC, Ing. Pacabaren.

4/ AID-DLC/P 2220: "Bolivia, Rural Sanitation", 21/2/77

duled by ELFIC for electrical system installation until phase number two, to wait until then for the potable water installations; and (b) that agro-industry location can likewise be scheduled to accord with ELFIC's plans.

Thirdly, we have assumed that the electricity to be supplied by ELFIC, subject of course to approval of the IDB loan this year, could come on stream within a matter of months of when diesel generating equipment financed by AID could begin to function, i.e. by late 1981 or early 1982.

Finally we have assumed that Phase 2 of the ENDE/ELFIC program will be put into effect in 1985, i.e. within the life of the proposed AID supported program.

2. Electrification Coverage

Table V J-1 describes the relationships between the ELFIC plans, the Proyecto Chapare proposals and the growth pole interests as defined in this report. As can be seen there is a match between 5 of the first priority growth pole locations and ELFIC plans for a first phase installation (Micro-zones 2,3,5,7, and 8). Three other micro-zones (nos. 4,6 and 9) will have electricity either via a match between a first priority growth pole (micro-zone no 4) and a second phase ELFIC installation, or /via a secondary growth pole and a first or second phase ELFIC installation. The only micro-zone not covered by the ELFIC plans in Tablas Monte (Micro Zone No. 1). This area is not normally considered part of the tropical Chapare and ELFIC may have other plans for it.

There is a match between the Proyecto Chapare proposals and the delineation of first priority growth poles in this report for 6 of the 9 micro-regions. Of the remaining three, one corresponds

Table V J-7

Population Centers to be Supplied Electricity Under Different Proposals

Population Center	First Priority as Growth Poles	Secondary Growth Poles	ELFIC Phase One	ELFIC Phase Two	First Phase Proyecto Chapare
Micro Zone No. 1					
Yablas Monte	X				
Micro Zone No. 2					
Ville Tunari	X		X		X
Paractito		X	X		X
Micro Zone No. 3					
Chipiriri	X		X		X
San Miguel			X		X
Micro Zone No. 4					
Eterozama	X			X	X
Sucre-Ieinuta		X			
Micro Zone No. 5					
Ville 14 de Septiembre	X		X		X
San Francisco				X	X
Micro Zone No. 6					
Paraiso	X				
Todo Santos		X		X	
Micro Zone No. 7					
Ibuelo	X		X		X
Central Busch		X	X		
Micro Zone No. 8					
Chimore	X		X		X
Micro Zone No. 9					
Valle Imirza	X				
Ivirgazama		X		X	X
Puerto Villaroel		X		X	X

to the zone one definitional problem mentioned above. The remaining two (Micro Zones 6 and 9) apparently correspond to differing evaluations of the appropriate population center to promote. This, in turn, is a consequence of the use of different criteria.

We did not attempt to ascertain whether there is any flexibility in ELFIC's planning. There certainly can and should be in the setting up of administrative centers and in locating agro-industries between first priority and secondary growth poles. With this caveat, we see no basic problem between the ENDE/ELFIC plans and the development program proposed in this report.

3. Potable Water Systems

Using as a universe the 15 first priority and secondary growth pole population groupings, Table V J-2 indicates which are scheduled for electrification by ELFIC and which have either had potable water systems already installed or are scheduled to receive this service with financial support from the AID Rural Sanitation Project. As can be seen, there are 4 villages where there is a match between planned provision of hydro-electricity and a need for a potable water system. In addition, there are two population centers where the need exists, but no hydro-electric installation is planned.

For four of the potential six beneficiaries of this activity the Proyecto Chapare report describes the present sanitary situation and gives a preliminary estimate of technical requirements and costs. These are as follows:

	(thousands of US$)
Villa Tunari	104,219
Eterazama	23,492

Puerto Villaroel	170,851
Sucre-Isinuta	23,492
TOTAL	322,054

Using the Eterozama/Sucre-Isinuta unit cost for the remaining two villages (Paraiso and Todo Santos) we come to a total cost for the 6 potential beneficiary centers of US$ 369,038. If the two villages which are not scheduled to receive ELFIC installed electricity systems are eliminated the cost drops to $322,054. Applying the same standard used in the design of AID Loan 2220, i.e. that approximately 15% of the total cost would come from community contributions, the program cost is reduced to a range of US$ 275,000 - 314,000.

-Administrative Arrangements

If it is decided to maintain this action element within the proposed program, it is recommended that it be planned for and funded under a convenio between the Area Development Authority and the Department of Environmental Sanitation (DSA). The convenio should specify that the same design standards, maintenance and administrative arrangements, etc. as pertain to the AID financial Rural Sanitation Project will also apply here.

Table V J-2

Population Centers Considered for Water Supply Systems

Population Center	To Be Electrified by ELFIC	Completed or Programmed Under USAID or UNICEF Sponsorship	Proposed by Proyecto Chaparé	Proposed for Funding Under this Program
Micro Zone No. 1				
Tablas Monte		X		
Micro Zone No. 2				
Villa Tunari	X		X	X
Paractito	X	X		
Micro Zone No. 3				
Chipiriri	X	X	X	
Micro Zone No. 4				
Eterazama	X		X	X
Sucre-Isinuta			X	X
Micro Zone No. 5				
Villa 14 de Septiembre	X	X		
Micro Zone No. 6				
Paraiso				X
Todo Santos	X			X
Micro Zone No. 7				
Ihuaio	X	X		
Central Busch	X	X		
Micro Zone No. 8				
Chimore	X	X	X	
Micro Zone No. 9				
Valle Inirza		X		
Ivirgazama	X	X		
Puerto Villaroel	X		X	X

VI. FINANCIAL IMPLICATIONS OF THE PROGRAM

The total cost of the proposed program comes to US$34.5 million (See Table V I-1). There is no component, with the possible exception of the small potable water activity (US$314,000), which could be deleted in its entirety without seriously affecting the viability of all the other components. Thus we will make no attempt to rank the 8 components of the program in terms of priority. Rather, if financing is an insuperable constraint, we would suggest examining each of the Components with a view to deferring certain activities to a second phase and/or reexamining certain of the financial mechanisms proposed. We would only add that, before concluding that the total financing for the 5 year period cannot be arranged, it is recommended, in view of the IDB interest in the Chapare, that the possibilities of a consortium be explored. Also, in view of the preponderance of local cost elements (see Table V I-1), the possibility of a larger than usual GOB contribution should be discussed with the appropriate authorities.

A. FINANCIAL MECHANISMS

As indicated above, there is a possibility of reducing costs by reconsidering certain proposed financial mechanisms. What is referred to here is the element of program design that provides for the Area Development Authority to make loans in the amount of US$5 million

to the vertically integrated corporations, to FENACRE, and to the enterprises described under the Agribusiness Program (See Table V I-2). The reasons that this financial mechanism was proposed were: (1) to strengthen the position of the ADA; (2) to increase the chances that the proposed enterprises could be rapidly brought into being; and (3) to provide a source of revenue for the ADA after the end of the present project. It is conceivable, however, that this US$5 million could be obtained from lines of credit now existing in the banking system and total program costs reduced accordingly, without insuperable damage to the overall program design.

B. DEFERMENT OR DELETION OF PROGRAM ACTIVITIES

The other mechanism for reducing program costs is to defer certain activities to a later phase of development of the Chapare, or even to delete activities within a major program component. Let us examine each program component from this standpoint.

1. Area Development Authority

The Impact Project Fund could be deleted at a savings of US$50,000. Consideration could also be given to reducing the provision for 5 man years of short term expatriate advisors to half this amount, at a savings of approximately US$260,000. Likewise, it might be possible to somewhat shorten the periods of service of full time advisors at a possible savings of approximately US$50,000. We wish to make clear that we

advance this suggestion about cutting back on advisory services with considerable reluctance and much trepidation. This could very well be a case of "penny wise, pound foolish". There is no way to tell in advance.

A third area which could be considered for a cutback -- there is no hard data behind the cost estimates shown -- is the US$610,000 budgeted over the life of the project for "Contract Services for Feasibility and Other Studies". This could perhaps be reduced by 50% for a potential saving of US$305,000. In sum, by cutting corners it might be possible to reduce the cost of this program component by approximately US$750,000. To this should be added a savings of US$365,500 shown in footnote to Table VI-1 as included in the total by error. Thus, the US$5,319,200 cost would be lowered to approximately US$4.2 million.

2. Vertically Ingrated Corporations

The possibility of handling the loan component of these 3 activities outside of the program has already been discussed.

In addition, the US$300,000 ADA equity participation in the rubber corporation scheduled for year 7 disbursement could be postponed until second phase financing was arranged for the region, although this is considered very risky and might cause private investors to hold back.

Another alternative, mentioned in the body of the report, is to explore the possibility of promoting one corporation with three product lines. It is believed this would result in some savings perhaps as much as US$500,000 of the US$2,762,500 shown in Table V I-2 under Grants and Direct Expenditure.

3. Research and Extension Program

This program component is very tightly budgeted. However, by postponing some activities to a later phase, e.g., commercial level production of pejivalle and field trials on coconuts, coffee and spices, a savings of approximately US$200,000 could be secured. In addition, if the estimate of needs for short term advisory services was cut back from 6 man months to 3 man months per year, a further reduction in program costs of approximately US$150,000 could be obtained. Thus the total potential reduction is US$350,000.

4. Communications

No cutbacks or postponements are considered feasible. The only "saving" is the US$38,000 error in vehicle operation and maintenance.

5. Credit Program

Under a worst case scenario from a financing viewpoint, consideration could be given to entrusting the entire credit delivery responsibility to BAB and eliminating FENACRE and the credit union complex from the program. In addition to the potential savings of US$1 million in loan

funds for relending purposes (see Table V I-2) discussed earlier under "Financial Mechanisms", this would permit reducing the grant component of this program by US$303,500.

6. Agribusiness Program

Possible savings were covered earlier under "Financial Mechanisms".

7. Area Transport System

The only aspect of this program component susceptible to postponement to a later phase of development of the region is new road construction. By reducing the work plan from 10 Km. per year to 5 Km. per year for this activity, a savings of approximately US$1 million could be obtained.

8. Electricity and Potable Water Program

As indicated earlier, this is the one program component which, if financial stringencies so dictated, could be completely deleted at a savings of US$314,000.

C. SUMMARY OF POTENTIAL SAVINGS

Applying the above "financial emergency" concepts to the various program components, we find the following situation:

	Initially Programmed	Potential Savings	New Total
Area Development Authority	5,319.2	1,086.0	4,233.2
Vertically Integrated Corps.	6,262.5	4,000.0	2,262.5
Research & Extension Program	7,428.0	350.0	7,078.0
Communications Program	403.0	38.0	365.0
Credit Program	1,452.5	1,303.5	149.0
Agribusiness Program	500.0	500.0	-
Area Transport System	12,820.1	1,000.0	11,820.1
Electricity and Potable Water Program	314.0	314.0	-
Totals	34,499.5	8,591.5	25,907.8

We see no way of executing a development effort in the Chapare that in any way resembles the proposed program concept at a cost lower than US$ 26 million.

We wish further to emphasize that the US$ 8.6 million shown as potential savings should not be regarded as excess trimmings which can be cut away without damage to the body of the program.

What this US$ 8.6 million represents are significient, but perhaps not irreparable, reductions in program content.

D. DISBURSEMENT SCHEDULE

Using the initially programmed cost estimates, a tentative disbursement schedule would be as follows:

Year	(US$ 000)
One	9,140.0
Two	6,203.9
Three	7,700.4
Four	5,515.3
Five	4,889.7
Seven	1,050.0 1/
Total	34,499.3

The above front end loaded disbursement schedule is predicated on the assumption that if the decision is made to proceed with this project, PRODES will have the time, authorization and resources to prepare for implementation prior to the beginning of year one of the program. This will involve establishing the legal basis for creation of the Area Development Authority, preparing draft convenios for first year operations, having architectural plans ready for construction activities, developing specifications for equipment to be procured, identifying and possibly recruiting key personnel, etc.

1/ Corresponds to a loan and equity participation in the proposed rubber corporation.

Table VI-1

Program Costs by Activity and by Foreign Exchange and Local Costs

	Total	(in 000 US$) FX Cost	Local Currency Cost*
Area Development Authority	5,319.2 (1)	198.9	5,120.4
Vertically Integrated Corps.	6,262.5	508.0	5,754.5
Research and Extension Program	7,428.0	3,066.0	4,362.0
Communications Program	403.2 (2)	36.9	366.3
Credit Program	1,452.5	99.8	1,352.7
Agribusiness Program	500.0	-	500.0
Area Transport System	12,820.1	1,690.7	11,129.4
Electricity and Potable Water Program	314.0	78.5	235.5
Totals	34,499.5	5,678.7	28,820.8

(1) This is the figure shown in Chapter IV. It is too high by US $ 356,500 due to an error in calculating vehicle operation and maintenance costs.
(2) This figure is also $ 38,000 too high, because of the same error.

* These dollar equivalents of the local currency costs of the program were calculated at an exchange rate of 20 pesos per dollar. Since the report was written, the peso was devaluated to 25 pesos per dollar. Using this new exchange rate, the local currency costs would be reduced to approximately $23,056,000.

Table VI-2

Use of Funds by Area Development Authority by Activity

	Total	Via Convenios and other agreements		Direct Expenditure
		Loans	Grants	
Area Development Authority	5,319.2	-	50.0	5,269.2
Vertically Integrated Corps.	6,262.5	3,500.0	1,330.5	1,432.0
Research and Extension Program	7,428.0	-	7,428.0	-
Communications Program	403.2	-	-	403.2
Credit Program	1,452.5	1,000.0	452.5	-
Agribusiness Program	500.0	500.0	-	-
Area Transport System	12,820.1	-	12,820.1	-
Electricity and Potable Water Program	314.0	-	314.0	-
Totals	34,499.5	5,000.0	22,395.1	7,104.4

NOTE: This table is not concerned with source of funds and whether external assistance is supplied on a grant or loan basis, but rather with the use to which the ADA will devote program funds from whatever source.

VII - FEASIBILITY CONSIDERATIONS

A. INTRODUCTION

The purpose of this analysis is to compare costs of the project with expected net benefits. Project costs include loans or grants from international assistance agencies, and contributions from the Government of Bolivia. Net benefits are defined as benefits which accrue to farmers as a result of the project and do not include income to them which would be expected had the project not been initiated. This farmer income has been "netted out". Non-farm income, e.g., profits of shareholders in proposed corporations is not included, even though a direct benefit of the project. As can be seen an extremely narrow definition of benefits is used.

Major cost items for the proposed program are as follows:

1. Area Development Authority
2. Vertically Integrated Corporations
3. Extension and Research Program
4. Communications Program
5. Credit Program
6. Agribusiness Program
7. Area Transport System
8. Electricity and Potable Water Program

Major net befits which can be ascribed to the project are:

1. Increased yields and net income from rotation farming and intercropping activities.

   a) Swine

   b) Cattle

   c) Citrus

   d) Pejivalle

   e) Pineapple

   f) Other Crops

2. Farmer income from Corporation activities in

   a) Rubber

   b) Tea

   c) Cacao

3. Savings to farmers from road system improvements and and improved handling and packing of output.

The above are net farmer benefits in the sense that production costs have been deducted from gross value of production. Labor costs have not been deducted.

The benefits listed above are direct benefits which can be measured or estimated empirically. There are two additional categories of benefits which are more difficult to handle in this type of analysis, but are nevertheless legitimate and real. One category includes such

direct benefits as improved health from potable water supplies and improved life styles resulting from better communications.

The second category is indirect benefits resulting from the infusion of additional money into the area, and depends on the phenomenon known as the multiplier effect. For example, money paid to road construction workers will be re-spent, mostly in the Chapare area. It will, in turn, benefit commerce and industry in the area and probably create some additional new jobs on third and subsequent passes through the economy. The multiplier effect has been estimated at 2 or more for an economy such as the Chapare.

Benefits and costs are compared by discounting the streams of benefits and costs. Since benefits are assumed to be greater than costs, and since costs in general, precede benefits chronologically, an interest rate or discount factor exists which equilibrates the two streams, or schedules: benefits and costs. This is known as the internal rate of return (IRR). Another well known method of comparison is to discount both schedules by an interest rate which represents the value of money for investment purposes. The ratio of the resulting total discounted benefits divided by discounted costs is known as the benefit-cost ratio and indicates a financially sound investment if the ratio is greater than unity.

Benefit cost analysis is relatively simple mathematically. There are, however, two risks involved:

a) Both costs and benefits are estimates since they represent the future. In this case, we are dealing with situations as far ahead as 1996. Consequently, sensitivity analysis will be conducted to show how great the errors might be before the proposed investments become financially unsound.

b) The allocation of resources may be misleading. Even if the analysis indicates that the program is financially sound, it does not mean that the money would not result in even greater benefits were it invested in different proportions in the same program, or invested in a different area or program altogether.

The simple hypothetical example below shows how benefit-cost ratios are derived.

Project Year	Costs		Benefits	
	Current	Discounted*	Current	Discounted*
1	10	8.33	0	0
2	10	6.94	5	3.47
3	10	5.79	20	11.57
4	5	2.41	30	14.47
Total	35	23.47	55	29.51

Discounted Value (20%)

Benefit-cost ratio 29.51/23.47, or 1.26

* $PV = FV(1+r)^{-n}$, where PV = present value; FV = future value; r = discount rate and n = project year.

The B/C ratio is greater than unity, which means that money invested in the project is expected to earn more than it would if invested at 20 percent which was assumed to be the cost of investment capital. If we feel insecure about this assumption, we can increase the discount rate up to 40% and still have a B/C ratio of greater than one (1.03). This is an example of the sensitivity analysis referred to above. It shows the sensitivity of the B/C ratio to changes in the discount rate. Incidentally, the internal rate of return for the above example is about 41 percent.

B. PRESENT PROJECT PROPOSAL

This project proposal shows project costs totalling about US$34.5 million. These are summarized in Annex No. 10, Table No. 1. Note that these are project costs, and do not include the expected investment from private sources.

Benefits to the project are also estimated from information contained in the report and are summarized in Annex No. 10, Table No. 2. These benefits represent only direct net returns to farmers which would not have accrued without the project. Not included are intangible returns, returns to the non-farm sector or benefits accruing to the general area due to the operation of the multiplier effect.

The schedule of costs generally includes an upward adjustment for inflation whereas prices have not been so adjusted in calculating benefits.

It is assumed that the number of farmers in the Chapare will increase from about 12,000 at the beginning of the project to around 19,000 in year 15 of the project. Fifteen years was chosen as the project life because all costs and over 75 percent of the benefits will have accrued by then (so far as we can estimate). Also, discounted value after 15 years is relatively insignificant compared to its original value (6.5 percent of original value when the discount rate is 20%). Table VII-1 shows the basic schedules of costs and benefits which are taken from Annex No. 10 and rounded to millions of U.S. dollars. In addition to the basic schedules of benefits and costs, the following schedules were constructed to determine the sensitivity of the B/C ratio to possible error:

1. Cost Schedule increased by 50 percent.

Since costs are frequently underestimated (or because costs sometimes "increase unexpectedly"), the basic cost schedule was augmented by 50 percent.

2. Operation and Maintenance costs added to basic cost schedule.

It might be argued that operation and maintenance costs for non-income-producing project activities (roads, research and extension, communications and the Area Development Authority) should be included for years 6 through 15 of the project.

TABLE VII-1

DISCOUNTED VALUES FOR BENEFIT COST ANALYSIS

Project Year	Costs (000,000 US$) Basic Schedule	Basic Schedule Plus 50%	Including O and M Costs 1/	Benefits (000,000US$) Basic Schedule	Delayed-Reduced Schedule 2/
1	9.14	13.71	9.14	.08	-o-
2	6.20	9.30	6.20	.77	-o-
3	7.70	11.55	7.70	3.03	-o-
4	5.52	8.29	5.52	7.29	2.00
5	4.89	7.34	4.89	11.56	5.00
6	-o-	-o-	2.00	13.92	10.00
7	1.05	1.58	3.25	14.32	12.00
8			2.42	14.66	14.00
9			2.66	14.94	14.94
10			2.93	15.29	15.29
11			3.22	15.83	15.83
12			3.54	16.49	16.49
13			3.90	17.23	17.23
14			4.29	17.67	17.67
15			4.72	18.09	18.09
Total	34.50	51.77	66.38	181.17	158.54
Discounted or present value at 20%	21.30	31.96	25.97	36.09	26.43
at 35%	16.18			15.48	

1/ Basic schedule plus 2 million per year beginning in year 6, and further adjusted upward by 10% per year beginning in year 7.

2/ Assuming no benefits in years one through three and only partial benefits in years four through eight.

3. Assumptions regarding adoption rates relaxed.

Certain assumptions regarding adoption by farmers of the new agricultural practices were made in the report. Although these appear reasonable when considering the activities individually, it might be argued that adoption rates are optimistic from the standpoint of the integrated program. Therefore, a benefit schedule was constructed which assumes no benefits whatsoever in the first three years and only partial benefits in years 4 through 8. This is a rather radical assumption, but some slippage in the benefit schedule would not be surprising.

The discount rate used for this analysis was 20 percent. Money invested presently in Bolivia will return 12 to 16 percent with a minimum of risk. Twenty percent seems a reasonable but conservative estimate for project years one through five. The "actual" discount rate could increase to almost 35 percent before the B/C ratio becomes less than 1.

B/C ratios, as obtained from the discounted schedules in Table VII-1, are as follows:

1.	Basic schedules at 20% discount rate	36.09 ÷ 21.30 = 1.69
2.	Basic schedules at 35% discount rate	15.48 ÷ 16.18 = 0.96
3.	Basic costs compared to Reduced benefits (20% discount rate)	26.43 ÷ 21.30 = 1.24
4.	Costs increased 50% compared to Basic Benefits (20% discount rate)	36.09 ÷ 31.96 = 1.13

5. Basic costs plus operation and maintenance compared to Basic Benefits (20% discount rate) 36.09 ÷ 25.97 = 1.51

6. Basic costs plus operation and maintenance compared to Reduced Benefits (20% discount rate) 26.43 ÷ 25.97 = 1.02

7. Costs increased 50% plus operation and maintenance compared to Reduced Benefits (20% discount rate) 26.43 ÷ 36.63 = 0.72

These B/C ratios can be used to test certain hypotheses (True if BC $>$ 1.0)

1. The project is financially sound (as a public investment) if the discount rate is 20 percent. True

2. The project is financially sound if the discount rate is 35 percent. False

3. The project is financially sound at a 20 percent discount rate if benefits are reduced (as stipulated) and costs remain the same. True

4. The project is financially sound at a 20 percent discount rate if costs are increased 50% and benefits remain the same. True

5. The project is financially sound if operation and maintenance costs are added and benefits remain the same. True

6. The project is financially sound if operation and maintenance costs are added and benefits are reduced. True

7. The project is financially sound if operation and maintenance costs are added to the inflated cost schedule and benefits are reduced. False

The above analysis is likely to invoke readers to respond with the old adage that "figures don't lie, but liars do figure". Admittedly, such an analysis can easily be twisted, but conservatism has been the watchword throughout.

A N N E X No. 1....

Detailed List of Centrales, Sindicatos and Membership by Micro Region

MICRO REGION No. 1 (Tablas Monte Locotal).

CENTRAL	SINDICATO	No. MEMBERS
TABLAS MONTE	1. San José	9
	2. San Julian	17
	3. Maica Monte	35
	4. Corani Pampa	32
	5. Puka Mayu	35
	6. Mosoj Llacta	44
	7. Jorke	25
	8. Tablas Monte	75
LOCOTAL	9. Paracti	35
	10. Locotal	60
	11. Miguelito	52
	12. San José	35
	13. Santa Isabel	32
	TOTAL	476

MICRO REGION No. 2 (Espíritu Santo - Villa Tunari)

CENTRAL	SINDICATO	No. MEMBERS
CENTRAL PARACTITO	1. San Rafael	80
	2. Paractito	119
	3. Pedregama	65
	4. Tres Arroyos	35
	5. Copacabana Alto	62
	6. Copacabana Bajo	45
	7. Belen Putintiri	25
	8. Itirapampa	15
	9. Mayurina	30
	10. Ivirzu Bajo	45
	11. El Palmar	30
	12. Kilómetro 118	18
	13. San Mateo Alto	30
	14. San Mateo Bajo	40
ESPIRITU SANTO	15. Jatumpampa-Buena Vista	130
	16. Villa Barrientos	30
	17. Cristal Mayu	45
	18. Ambrosia	62
	19. Campo Vias	46
	20. Banda Azul	30
	21. Lagunillas	35
	22. Chocotal	45
		1,082

MICRO REGION No. 3 (Chipiriri)

CENTRAL	SINDICATO	No. MIEMBROS
CHIPIRIRI	1. Villa Esteban Arze	52
	2. Colorado Tacuarai	90
	3. Alto Ibuelo	90
	4. Santa Elena	35
	5. Senda Bajer	140
	6. San Miguel 23 de Octubre	60
	7. Chipiriri	90
	8. Rio Alto	30
		587

MICRO REGION No. 4 (Isiboro - Litoral)

CENTRAL	SINDICATO	No. MEMBERS
BOLIVAR	1. Mayor Jordán	58
	2. Churo Samuzabaty	90
	3. San Pedro	80
SUCRE ISINUTA	4. Abaroa	50
	5. Florida	64
	6. Villa Mercedes Isinuta	110
	7. Isiboro	56
	8. Mariscal Sucre Alto	140
	9. Mariscal Sucre Bajo	70
LITORAL	10. Aroma	160
	11. Buena Vista	118
	12. Coripata	35
	13. Santa Rosa	45
	14. Bomborazama	120
	15. San Jose	124
	16. Estancia	55
	17. Antofagasta	48
	18. Pto. Trinitario	87
	19. Bolivar	86
	20. Puerto Sucre	48
	21. Puerto Valle	73
ETERAMAZAMA	22. Villa Rosario	78
	23. San Pablo	126
	24. Miraflores	98
	25. Cerro Verde	82
		2,101

425

MICRO REGION No. 5 (14 de Septiembre - San Francisco)

CENTRAL	SINDICATO	No. MEMBERS
VILLA 14 DE SEPTIEMBRE	1. San Miguel Alto	110
	2. Centro Simón Bolivar	160
	3. Norte Central	103
	4. Barrientos	120
	5. Villa Porvenir	200
	6. Colonia Litoral	140
	7. P.D. Marillo	84
	8. Gualberto Villarroel	50
	9. Santa Fé	60
	10. Villa Samuel San Juan	30
	11. San Carlos	180
	12. Villa Jordan	140
	13. San Pedro	136
	14. Villa Carmen	40
2 DE AGOSTO	15. San Cristobal	60
	16. San Francisco Alto	86
	17. San Francisco Bajo	186
	18. Villa Asunción	95
	19. Villa Israel	100
		2,010

MICRO REGION No. 6 (Paraiso-Puerto Todos Santos)

CENTRAL	SINDICATO	No. MEMBERO
TODOS SANTOS	1. La Estrella	45
	2. Paraiso	140
	3. San Isidro	35
	4. Fátima	85
	5. Mejillones	31
	6. Antofagasta	52
		388

MICRO REGION No. 7 (Ibuelo - Lauca)

CENTRAL	SINDICATO	No. MEMBERS
IBUELO	1. Majo Pampa	68
	2. Agrigento A	56
	3. Agrigento B	60
	4. Ibuelo	130
	5. Dorado Chico	30
	6. San Luis	120
	7. Villa Fernandez	45
	8. San Isidro	120
	9. San Jose de Chiquitos	60
LAUCA ÑEÑE	10. Lauca Ñeñe	77
	11. Santa Fé	37
	12. San Francisco	61
	13. Simaute	33
	14. Monte Rico	44
	15. Santa Rosa	54
	16. Illimani	42
GERMAN BUSCH	17. Puerto Aurora	28
	18. Carmen Cani	71
	19. Bolivar	72
	20. Valle Hermoso	64
	21. Villa Carrasco	80
	22. F. Tropical	70
	23. Coop. La Victoria	100
	24. Busch	80
		1,637

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MICRO REGION No. 8 (Chimore - Melga)

CENTRAL	SINDICATO	No. MEMBERS
CHIMORE	1. Senda III	87
	2. Senda II	18
	3. Senda A	25
	4. Senda B	99
	5. Senda C lado Este	26
	6. Senda C lado Oeste	22
	7. Senda D	68
	8. Senda E	56
	9. Senda F	56
	10. Variente Carmen	18
	11. Santa Rosa	24
PUERTO ALEGRE	12. Puerto Alegre	30
	13. Inavi	80
	14. San Salvador	30
	15. San Joaquín	28
	16. Rosario	22
	17. Ayopaya	76
	18. Guardia Tucumán	38
	19. 2 de Agosto	30
	20. Trinitario	20
MELGA	21. Troncal	20
	22. Senda III 6 Camargo	40
	23. Senda IV 6 Paraíso	24

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	24. Villa Agurduy	40
	25. Colonia Palmito	40
	26. Colonia 3 Pozas	38
	27. Senda V ó Nueva Linares	50
	28. Senda VI ó Colonia Malga	45
	29. Senda VII ó San Carlos	42
	30. Barrientos	115
MARIPOSAS	31. Cesarzona	90
	32. Suipacha	85
	33. San Pablo	65
		1,547

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MICRO REGION No. 9 (Ivirza - Pto. Villarroel)

CENTRAL	SINDICATO	No. MEMBERS
VALLE IVIRZA	1. Valle Ivirza	110
	2. Transversal	21
	3. Colonia 9 de Agosto	26
	4. Colonia Tarata	35
	5. Valle Hermoso	59
	6. Gualberto Villarroel	96
	7. Bolivar	68
	8. San Lucas	43
	9. Villa Nueva	70
	10. Villa Cristal (Nueva Belén)	17
	11. Villa Verde	20
	12. Ingavi	28
	13. Monterrey	30
	14. 14 de Septiembre	30
	15. Germán Busch	45
	16. 2 de Marzo	60
	17. Buena Vista	19
	18. Valle Cristal	11
VALLE SAJTA	19. Sajta	35
	20. Puerto Bolivar	38
	21. Mazareño	69
	22. Kolla Suyo (Daza Ordanza)	88
	23. Topater	42
	24. Colonia Potosi	40

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	25. Nueva Esperanza	102
	26. El Palmar	35
CENTRAL VALLE IVIRGARZAMA	27. Valle Ivirgarzama	32
	28. Valle Central	35
	29. Colonia A	70
	30. Colonia B	114
	31. Colonia C	94
	32. Remedios	12
	33. Sanda VIII	24
		1,618

SUMMARY

No.	MICRO-REGION	NUMBER CENTRALES	NUMBER SINDICATOS	NUMBER MEMBERS
1	Tablas Monte - Locotal	2	13	476
2	Espíritu Santo - Villa Tunari	2	22	1,032
3	Chipiriri	1	8	587
4	Isiboro - Litoral	4	25	2,101
5	14 de Septiembre - San Francisco	2	19	2,010
6	Paraiso - Pio. Todos Santos	1	6	388
7	Ibuelo - Lauca Ene	3	24	1,637
8	Chimoré - Melga	4	33	1,547
9	Ivirza - Puerto Villarroel	3	33	1,618
		22	183	11,446

Annex N° 2

Estimates Of Cultivated Area In The Chapare -1978

KARL HOFFMAN E.

Regional Office - PRODES-CHAPARE

1/	Centrales	(1) N° Sindicatos	(2) N° Farms	(3) Area (Ha.) Colonized	(4) Rice	(5) Coca
S	Espíritu Santo	8	378	3,780	57	50
S	Tablas Monte	8	265	2,650	-	30
S	Locotal	6	212	2,120	-	20
S	Paracitito	14	653	6,530	550	600
S	Ibuelo	9	718	7,180	1,300	1,000
S	Chipiriri	8	599	5,990	250	600
S	Villa 14 de Septiembre (*)	16	1,727	17,270	3,000	1,000
S	Central Busch	8	588	5,880	600	900
S	Lauca Ñ	6	284	2,840	500	100
S	Litoral	10	842	8,420	420	800
S	Todos Santos	5	326	3,260	300	40
S	Eterazama	4	381	3,810	600	600
S	Bolivar	3	225	2,250	500	300
S	Sucre Isunita	6	446	4,460	800	200
D	Chimore	11	502	10,020	700	250
D	Mariposas (**)	4	200	4,000	200	30
D	Melga (**)	9	450	9,000	450	200
SD	Pto. Alegre	7	314	6,280	620	80
SD	Valle Ivirza	17	833	16,[illegible]00	2,400	300
SD	Valle Sajta	7	411	8,220	800	100
SD	Colonias Indep (***)	3	685	13,700	700	110
	Total	169	11,039	144,320	14,747	7,310
	Directed	58	3,395	67,880	5,870	1,070
	Spontaneous	111	7,644	76,440	8,877	6,240

1/ S-Spontaneous, D-Directed, SD-Semi-Directed. Directed and Semi-Directed are considered as directed in the totals at bottom of page because the original grant was 20 hectares for both. Spontaneous settlers received only 10 hectares.

Note:

Although the number of farms and members of sindicatos for 1979 is 11,446, it is estimated that the number of families is approximately 10,500 since some of the colonists have more than one farm.

Annex N° 2 (continued)

1/	Centrales	(6) Area Banana	(7) Cultivated (in Has.) Citrus	(8) Papaya	(9) Chile Pepper	(10) Others
S	Espíritu Santo	110	120	25	30	200
S	Tablas Monte	80	100	10	87	150
S	Lecotal	60	100	10	53	100
S	Paraíltito	150	800	30		600
S	Ebuelo	700	800	50		700
S	Chipiriri	200	600	30		600
S	Villa 14 de Septiembre (*)	2,500	1,100	100		1,500
S	Central Busch	100	300	10		600
S	Lauca Ñ	120	160	10		300
S	Litoral	600	500	30		200
S	Todos Santos	900	300	60		400
S	Etazamana	190	100	10		400
S	Bolivar	50	90	5		200
S	Sucre Isunita	90	120	10		500
D	Chiñoro	500	300	30		500
D	Mendoza (**)	20	30	[illegible]		200
D	Bolga (**)	45	45	5		450
SD	Pto. Alegre	260	190	10		300
SD	Valle Ivirza	300	150	10		800
SD	Valle Sajta	80	50	5		400
SD	Colonias Indep. (***)	250	200	30		700
	Total	7,305	6,155	465	170	11,400
	Directed	1,455	965	95	0	3,350
	Spontaneous	5,850	5,190	390	170	8,050

(*) The Villa 14 de Septiembre Central has split into 2 parts: Valle 14 de Septiembre and 2 de Agosto o San Francisco.

(**) The neighboring centrales are disorganized and there is no definitive delimitation of the Sindicatos.

(***) Organized as the Central Ivirgarzama.

Annex N° 2 (continued)

1/	Centrales	(11) Total	(12) Cultivated Area Per Farm (Ha.)	(13) Area In Brush Fallow (Ha.)	(14) Forest Not Cultivated (Ha.)
S	Espíritu Santo	592	1.57	550	2,630
S	Tablas Monte	457	1.72	500	1,693
S	Locotal	343	1.62	150	1,627
S	Paracitito	2,730	4.18	2,000	1,800
S	Ibuelo	4,550	6,34	2,200	430
S	Chipiriri	2,280	3.81	2,000	1,710
S	Villa 14 de Septiembre	10,200	5.91	3,500	3,570
S	Central Busch	2,510	4.27	2,000	1,370
S	Lauca Ñ	1,190	4.19	700	950
S	Litoral	3.150	3.74	1,600	3,670
S	Todos Santos	2,000	6.13	600	660
S	Eteramaza	1,900	4.99	1,000	910
S	Bolivar	1,145	5.09	400	705
S	Sucre Isunita	1,720	3.06	500	2,240
D	Chimore	2,280	4.54	3,000	4,740
D	Mariposas (**)	485	2.43	500	3,015
D	Melga (**)	1,195	2.66	900	6,905
SD	Pto. Alegre	1,460	4.65	600	4,220
SD	Valle Ivirza	3,960	4.75	2,000	10,700
SD	Valle Sajta	1,435	3.49	800	5,985
SD	Colonias Indep. (***)	1,990	2.91	2,000	9,710
	Total	47,572	4.31	27,500	69,208
	Directed	12,805	3.77	9,800	45,275
	Spontaneous	34,767	4.55	17,700	23,973

ANNEX NO. 3

CHAPARE FRUIT PACKING

(Glossary)

FRUIT		
Oranges	"A granel" by truckloads of 40-70,000 fruit	
Mandarins	"jaba" of 800-1,000 fruit, weight 115-145 Kg.	
Bananas	Loose stems packed in truck tightly and wrapped in banana leaves; truckload is 100 chipas or approx. 9 tons.	
Plantain	Same as bananas - 60-65,000 fruit per 9 ton. Load	
Papaya	"jaba" containing 120 units, weight 120-200 Kg.	
Pineapple	"A granel" but loaded on truck individually	
Watermelon	Same	
Avocado	"A granel" picked green and hard when supplies are heavy	"Jaba" or "cajones" when supplies are light. "Jaba" contains approx. 500 fruit, 175 Kg.
Mango	Same	Same

"A granel" - Loose, whether in a truck or on the ground; the truck is divided into a series of compartments by poles and nets arranged vertically, horizontally and on diagonals.

"Jaba" - A rough, opensided wooden crate, holding 100-200 Kg. of fruit depending on the variety. The crate normally belong to the buyer and is supplied by him to the farmer.

"Chipa" - In the Chapare 4 racemes of fruit totalling 720 units, and weighing approx. 90 Kg.

"Cajón" - A closed - sided wooden crate imported into Bolivia with Argentine fruit. This is the normal pack for tomatoes in the Chapare, and is sometimes used for avocados and mangos.

"Canasta" - A woven straw basket used to load and unload fruit, and occasionally to package avocados and mangos. Rare.

ANNEX No. 4

SUPPLY/DEMAND SITUATION FOR CURRENT LINES OF PRODUCTION

PINEAPPLE

	NATIONAL PRODUCTION (NET TONS.)			CHAPARE PRODUCTION (NET TONS.)		
	SUPPLY	DEMAND	BALANCE	SUPPLY	DEMAND	BALANCE
1974	7,860					
1975	8,600					
1976	8,800					
1977	9,720					
1978	11,400					
1979	11,736			2,508		
1980	12,556					
1985	16,656					
1990	20,756					
1995	24,856					
2000	28,956					

SOURCE: Medina 1974 - 1978, 1979 - 2000 CLS Projection

YUCA

	NATIONAL SUPPLY/DEMAND							COCHABAMBA · SUPPLY / DEMAND						
	Product. net.tons.	Farm Consum % losses	Supply	Marketing losses %		Demand	Balance	Product. Net.tons.		Supply	Marketing losses		% Demand	Balance
1975	285.350	142.675	142,675	14,267	10	72,886	+ 54,522	27,054	18,938	8,116	812	10	5,499	+ 1,805
1976	304,700	152,350	152,350	15,235		75,659	61,486	28,163	19,714	8,449	845		5,576	2,028
	294.400	147,200	147,200	14,720		75,274	54,206	29,320	20,524	8,796	880		5,714	2,202
	306,250	153,125	153,125	15,313		80,789	57,028	30,520	21,364	9,156	916		5,852	2,388
	317,715	158,858	158,858	15,886		81,238	61,734	31,771	22,239	9,532	953		5,813	2,766
	321,567	160,783	160,784	16,078		83,919	60,787	32,903	23,032	9,872	987		5,962	2,923
	354,707	177,353	177,354	17,755		93,836	65,783	38,798	27,159	11,641	1164		6,414	4.063
	387,84	193,923	193,924	19,392		103,753	70,779	44,693	31,285	13,411	1341		6,866	5,204
	420,987	210,493	210,494	21,049		113,670	75,775	50,589	35,412	15,180	1518		7,318	6,344
	454,127	227,063	227,064	22,706		123,587	80,771	56,485	39,540	16,950	1695		7,770	7,485

PLANTAINS AND BANANAS

NATIONAL SUPPLY/DEMAND							COCHABAMBA SUPPLY/DEMAND						
	PRODUCTION M/T	FARM CONSUM. & LOSSES	SUPPLY	MARKETING LOSSES	DEMAND	BALANCE	PRODUCTION M/T	FARM CONSUM. & LOSSES	SUPPLY	MARKETING LOSSES	DEMAND	BALANCE
1975	392140	137249	254845	35685	182959	36202	196070	68625	127445	19117	92900	15428
1976	399000	139650	259350	36300	189363	33687	199500	69825	129675	19451	96152	14072
1977	403000	141050	261950	36700	198578	26672	201500	70525	130975	19646	99517	11812
1978	399000	139650	259350	36300	208375	14675	199500	69825	129675	19541	103000	7224
1979	408291	142475	265815	37200	209950	18666	204145	71451	132694	19904	106605	6185
1980	409977	143151	266826	37356	219743	9727	204988	71746	133242	19986	109912	3344
1985	426128	149144	277751	38885	256240	- 17374	213063	74572	138491	20774	127041	- 9324
1990	442278	153602	288676	40415	292737	- 44476	221138	77398	143740	21561	144170	-21991
1995	458430	158829	299601	41944	329234	- 71577	229213	80224	148989	22348	161299	-34658
2000	474581	164055	310526	43474	365731	- 98679	237288	83050	154238	23136	178428	-47326

SOURCE: Medina, 1975-1979; 1980-2000 OLS Projection

NATIONAL PRODUCTION (Met. tons) | Chapare Production

PAPAYA

		PRODUCTION	LOSSES	SUPPLY	PRODUCTION	LOSSES	SUPPLY
	1972				1,510	528.5	981.5
1	1975	6,750	2,363	4,387			
2	1976	6,875	2,406	4,469			
3	1977	6,875	2,406	4,469			
4	1978	7,540	2,639	4,901			
5	1979	7,602	2,661	4,941			
6	1980	7,840	2,744	5,096			
11	1985	9,025	3,159	5,866			
16	1990	10,210	3,574	6,636			
21	1995	11,395	3,988	7,407			
26	2000	12,580	4,403	8,177			

SOURCE: MACA (1979) 1975 - 1978, 1979 - 2000 OLS Projection | SOURCE: Figueras

TEA

NATIONAL SUPPLY/DEMAND (Met. tons) | Chapare Potential

		SUPPLY	DEMAND	BALANCE	IMPORTS	VALUE $US.	PRODUCTION	EXPORT
	1972				389	449,869		
	1973				459.1	560,281		
	1974				534	711,518		
	1975				473.2	601,602		
	1976				412.5	507,300		
	1977							
1	1978	228	482.3	254.3				
2	1979	240	499.2	259.2				
3	1980	265	516.7	251.7		1,981	350	100
8	1985	355	602.6	247.6		1,985		102
13	1990	448	688.6	240.6		1,990		110
18	1995	540	774.6	234.6		1,995		115
23	2000	633	860.6	227.6		2,000		122

SOURCE: Medina

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RICE

	NATIONAL SUPPLY/DEMAND (NET TONS.)			CHAPARE SUPPLY/DEMAND (NET. TONS.)		
	Supply	Demand	Balance	Supply	Demand	Balance
1975				11,376	11,413	- 37
1976	79.131	70,516	+ 8,615	14,555	11,527	+ 3,028
1977	78,200	71,158	7,042	26,509	11,642	14,867
1978	62,006	73,741	- 11,735	11,224	11,759	- 535
1979	67,832	74,685	6,813	-	11,876	-
1980	69,596	76,323	6,729	-	11,994	-
1985	79,126	83,854	4,728	-	12,605	-

Source: Medina

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CORN

	NATIONAL SUPPLY/DEMAND (MET. TONS.)				COCHABAMBA SUPPLY/DEMAND		
	SUPPLY	MARKETING LOSSES %	DEMAND	BALANCE	SUPPLY	MARKETING LOSSES %	BALANCE
1979					14,920	26,420	-11,500
1980		n. a.			15,188	27,213	12,075
1981					15,462	28,029	12,567
1982					17,740	28,870	13,130
1983					16,023	29,736	13,713
1984					16,311	30,620	14,309
1985					16,605	31,547	14,942
1990					17,996	35,748	17,752
1995					19,400	40,017	20,617
2000					20,804	44,285	23,481

SOURCE: MEDINA 1979 - 1985, OLS PROJECTION LATER YEARS

C I T R U S

	NATIONAL SUPPLY/DEMAND (Met. tons.)					COCHABAMBA SUPPLY/ DEMAND				
	SUPPLY	MARKETING LOSSES	%	DEMAND	BALANCE	SUPPLY	MARKETING LOSSES	%	DEMAND	BALANCE
1975	67,050	13,410	20	44,713	+8,927	9,387	1,877	20	4,145	+ 3,365
1976	76,500	15,300		47,172	14,028	10,710	2,142		4,407	4,161
1977	79,200	15,840		51,298	12,062	11,088	2,217		5,123	3,748
1978	80,000	16,000		54,916	9,084	11,200	2,240		5,378	3,582
1979	83,772	16,755		55,391	11,626	11,728	2,346		5,293	4,089
1980	88,388	17,678		59,428	11,282	12,374	2,475		5,849	4,050
1985	106,860	21,372		73,978	11,510	14,960	2,992		7,483	4,485
1990	125,332	25,066		88,528	11,738	17,546	3,509		9,116	4,921
2000	162,276	32,455		117,628	12,193	22,718	4,544		12,383	5,791

Source: MEDINA 1975 - 1979 , 1980 - 2000 OLS PROJECTION

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Annex N° 5

FENACRE Proposal for Developing Credit Unions in the Chapare

A. General Statement

The program of promoting credit unions in the Chapare under the direction of the National Federation of Credit Unions, FENACRE, is designed to integrate the settlers into the credit union movement and to contribute to raising the levels of family income and productivity in the area.

B. General Objectives

1. Promote the organization and development of CUs in the Chapare.
2. Promote cooperative concepts.
3. Stimulate member savings.
4. Contribute to a higher standard of living through financial assistance, education and improved production in agriculture, livestock, small industries and handicrafts.
5. Develop proper administrative and organizational practices within the developing CUs.
6. Affiliate the CUs with the national federation.
7. Coordinate efforts and resources with other public and private organization having similar objectives to those of FENACRE.
8. Contribute to the improvement of agricultural production in the area.

C. Project Duration

The development of the program is divided in two phases and will be in accordance with FENACRE's policies, proceedures and services.

1. Promotion and Organization

A 4 year period starting with the opening of the FENACRE office in the Chapare (probably Villa Tunari) and ending when the selected CUs have

affiliated with FENACRE.

2. Development and Assistance

This phase starts once each CU has affiliated with FENACRE and is receiving its services. The duration of this is unlimited.

3. Note: -The program will depend upon economic support during a 4 year period. However, it is expected that during this time, the system of CUs will be sufficiently self-financing so that a regional office of FENACRE can be established and maintain it's full range of services to the CUs.

The management and funding requirements have been set out for the first two years. At the end of the period an evaluation will be made to determine what level of assistance will be needed for the last two years.

D. Operational Goals For The First Two Years

1. Establish during the first year an office for the Chapare program with the necessary equipment and materials for promotion, assistance and education.
2. Promote in the first year the organization of 10 CUs in the different areas of Chapare.
3. Enroll in the first year at least 1000 members among the CUs that already exist and those to be formed.
4. Provide the CUs with efficient organization and professional administration that will assure:

   a. Good services to the members.
   b. Development of the human resources within the CUs.

c. Daily administration and accounting.

d. CU self-sufficiency.

e. CU capacity to receive external loan capital from FENACRE, banks and other institutions.

5. Develop and conduct programs of assistance in promotion, education, administration, finance, accounting, etc.
6. Exercise long term control over the activities and programs that the CUs develop.
7. Establish and maintain coordination with the Bolivian Institute of Agricultural Technology (IBTA) in all aspects of agricultural production in the Chaparo.
8. Coordinate with the existing system of syndicates in the establishment and management of the CU system.
9. Assist in the development of a consumer section within each CU as a social and economic service to the communities.

B. Activities for the first two years

1. Organization of the central office, probably in Villa Tunari (first year).
2. Select, employ and train the team of promoters and assistants (first year).
3. Carry out orientation meetings in the population centers of the area (first year).
4. Identify dedicated leaders in each community (first year).
5. Promotion campaigns to organize CUs in selected zones (first year).
6. Appoint organizing committees in the selected zones for carrying out the organizing program (first year).
7. Intensify educational activities at the organizer level (Continuous).
8. Assist in the organizing efforts (constitutional assemblies, selection of directors, development of capital, socio-economic studies, administration, accounting, expedite legal action, etc). (Continuous).

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9. Provide services to members during the first year a CU starts.
10. Selection and training of managers, preferably persons from the area (first year).
11. Intensive promotion of members and savings in the organized CUs.
12. Affiliation of the organized CUs with FEDECRE.
13. Make available the full range of FEDECRE services to the qualified, affiliated CUs.
14. Develop specific programs for:

    a. Each CUs future development during the next 3 to 5 years.
    b. Projects in agriculture, livestock and handicrafts at the member and member group levels for channeling credit for the production of corn, rice, citrus, etc. according to the development program for the Chapare.
    c. Small business investment projects for the CUs that relate to member activities, e.g. a small rice mill, a corn sheller, an orange juice concentrate plant, a chicken production or feed production enterprise, etc.

Program Implementation

A. Personnel

1 Chief of Program.
1 Secretary/ assistant.
2 Promotor/educators.
4 Technicians in training, administration and auditing.
10 Managers under FEDECRE management contracts.

Basic functions

A. Chief of Program

Responsible for achieving the goals and plans of the program.
- Plans, organizes and directs the program.

- Coordinates with other institutions.
- Contracts for special assistance and temporary services.
- Is responsible to the FENACRE division of Technical Assistance.

b) Secretary

- Secretarial services.
- Completing forms, vouchers and files.
- Attends to radio service.
- Controls program equipment and assets.

c) Promotors

- Assists and develops promotion campaigns for members and savings.
- Carries out education and training programs.
- Assists in all the promotional work of the CUs for signing up members, developing social capital, and expediting CU legalization.
- Is the link between the CU and FENACRE.
- Responsible to the Chief of Program.

d) Technicians

- One is responsible for training and assistance in CU administration.
- One is responsible for the development of agricultural and livestock production program for CU members requesting loans for agricultural production.
- One is responsible for assisting CU members with commercialization of their products.
- One is responsible for education and training.

The technicians are responsible to the Chief of Program.

e) Managers

- General administration of the CU, based on work plans developed by FENACRE.
- They work under a management contract between FENACRE and the CU whereby FENACRE temporarily manages the CU until the CU's personnel are trained to assume the CU's management.
- The managers are on loan to the CUs. FENACRE's costs are either repaid by the CU as if it were a loan, or are given as a grant to the CU. This will be decided when the program starts.

2. Equipment

		(US dollars)
1	Office Building and land +	20,000
8	Desks	2,000
7	Executive chairs	1,050
1	Secretarial chair	125
10	Reception chairs	150
2	Work tables	100
5	Fans	1,050
1	Refrigerator	600
10	Typewriters ++	4,800
10	Typewriters tables	600
6	Calculators with tape ++	750
4	Calculators without tape ++	150
40	Small writing desks	1,000
1	Radio and mobile units ++	5,000
7	Four wheel drive vehicles ++	70,000
2	Movie projectors with screen ++	2,000
3	Generators ++	2,200
2	Slide projectors with screen ++	800
1	Multi-copy machine ++	2,000
1	Blackboard, large	100
2	Portable blackboards	150
4	File cabinets	700
1	Safe	750
1	Opaque projector ++	1,000
2	Video cassettes, complex ++	6,000
8	Portable recorders ++	1,200
4	Planographs	600
2	Book cases	400
7	Sleeping bags	700
	TOTAL (approx. and subject to change)	$ 127,000

\+ The program requires a modern and functional building at the headquarters site.

++ The prices are estimated based on local market prices. Would be lower if obtained through a grant.

3. Operating budget for two years

a) Personnel (US dollars)

	per month	per year	Two year Cost
Chief of Program	$ 500	$ 6,000	$ 12,000
Secretary	250	3,000	6,000
Promotor N° 1	350	4,200	8,400
Promotor N° 2	350	4,200	8,400
Administration Tech.	450	5,400	10,800
Production Technician	450	5,400	10,800
Marketing Technician	450	5,400	10,800
Education Technician	450	5,400	10,800
Total Salaries	3,250	39,000	78,000
Plus: Year end bonus, social security benefits, etc.	1,138	13,650	27,300
Plus: Incentive bonus	612	7,350	14,700
Total personnel servs.	5,000/mo.	60,000/yr.	120.000/2yr.

b) Operational Costs

Travel $ 150,-mo./ empl. 1/	900	10,800	21,600
CU operations/grant 2/	10,000	120,000	240,000
Fuel, maintenance, depreciation 3/	1,750	21,000	42,000
Admin. costs 4/	1,000	12,000	24,000
Personnel housing $ 120/mo.per empl.	875	10,500	21,000
Miscellaneous	475	5,700	11,400
Total Operational Cost	15,000	180,000	360,000
Grand Total	20,000/mo.	240,000/yr.	480,000/2 yr.

Notes:

1/ The average perdiem per technician is 20 days/mo., at 7.50 day. This includes lodging, food, others.

2/ CU operations grant includes: managers' salary, educational activities, promotion, interin payment to persons being trained to manage CUs.

3/ Vehicle operation, maintenance and depreciation is calculated at $ 250/mo. if they are purchased locally and not donated.

4/ General administrative costs include: Light, water, building maintenance, depreciation, supplies, insurance, office equipment and licences, furniture maintenance, special services, etc.

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G. General Observations

The program will develop procedures to minimize the effects of inflation and devaluation on the CUs and their members.

The program can begin in 1981 with the signing of the necessary agreements between FENACRE and the financing agency.

FENACRE Commercialization Services to CUs are not available now. They are planned for the course of next four years.

H. FENACRE Services to CUs

- Education & Training

(1) For members	(2) For directors	(3) For employees
Short courses	Short courses	Short courses
Audiovisual courses	National and regional courses	Audiovisual courses
Correspondence courses	Seminars	National and Regional Semn.
Group discussions	Group dynamics	Administration courses
Radio courses	Panels and conferences	Group dynamics
		Correspondence courses in accounting.

- Auditing

Annual operation audits

Quarterly audits

Assistance to supervisory committees

Internals controls

- Extension and Promotion

(1) Administrative Assistance	(2) Cooperative Promotion	(3) Public Relations
Administration for CUs	Cooperative organization	Assistance with official representations
Accounting	Membership campaigns	Relations with FENACRE
Growth and development plans	Savings campaigns	Information
Financial projections	Service promotion campaigns	Organization of assemblies and conferences
Project development		
Audit follow-up		

- Financial Services

(1) Credit	(2) Insurance
Production loans	Guaranty
Working capital loans	Savings and loan protection
Financial projections	Life Insurance
	Accident Insurance (director and employees)

- General Services

(1) Printing and materials	(2) Commercialization
Administrative forms	Importation and sale of agriculture inputs (in process)
Offices supplies	Marketing agricultural and livestock products (in process).
Reports, bulletins, folders	
Promotional material	

- Administration

CU Management Services while CU is being organized.

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I. Financing plan and credit use

Program Goals-Organize 10CUs, at the following sites: Espíritu Santo, Paracitito, Ibuelo, Central Busch, Chimoré, Mariposas, Valle Ivirza, Villa 14 de Septiembre, Chipiriri, and Eteramazama.

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Number Of Members And Area To Be Cultivated

Period	Member Growth	Total Members	Total Area Has.
1st. year	1.000 x 2 Ha.	1,000	2,000
2nd. year	1.000 x 3 Ha.	2,000	5,000
3rd. year	1.000 x 3 Ha. 1.000 x 4 Ha.		
	1.000 x 3 Ha.	3,000	9,000
	1.000 x 2 Ha.		
4th. year	1.000 x 5 Ha.		
	1.000 x 4 Ha.	4,000	14,000
	1.000 x 3 Ha.		
	1.000 x 2 Ha.		
Total		4,000	14,000

Project Financing*

(US dollars)

Year	Area (Ha.)	Total Cost	Member Contribution	Loan	Cost/Ha.
1	2,000	960,000	160,000	800,000	480
2	5,000	1,500,000	250,000	1,250,000	300
3	9,000	2,220,000	370,000	1,850,000	246
4	14,000	3,120,000	520,000	2,600,000	222
	30,000	7,800,000	1,300,000	6,500,000	260

*Production costs/Ha. decline due to yearly increase in the number of cleared hectares.

Capitalization Of The Credit System

(US dollars)

Year	Loans	Capitalization 10% of Loans
1	800,000	80,000
2	1,250,000	125,000
3	1,850,000	185,000
4	2,600,000	260,000
Total	6,500,000	650,000

Project Cost And Fund Sources

	(000 US $)
Total Cost	$ 7,800
Aid Loan	3,000
Reflows	2,727
Interest	234
Capitalization fund	390
FENACRE recourses	149
Member Contribution (Labor)	1,300
Total	7,800

Aid Loan Disbursement

Year	(US dollars)
1	$ 800,000
2	750,000
3	750,000
4	700,000
Total	$ 3,000,000

Loans and Recoveries for Ag. Credit/Year

Year	Loan Area		Amount	Recoveries 2	3	4	5	Total
1		LT	500,000	90,000	90,000	90,000	90,000	360,000
	2,000	ST	300,000	270,000	6,000	6,000	6,000	288,000
2		LT	500,000	-	90,000	90,000	90,000	288,000
	5,000	ST	750,000	-	675,000	15,000	15,000	705,000
3		LT	500,000	-	-	90,000	90,000	180,000
	9,000	ST	1,350,000	-	-	1,215,000	27,000	1,242,000
4		LT	500,000	-	-	-	90,000	90,000
	14,000	ST	2,100,000	-	-	-	1,890,000	1,890,000
Total		LT	2,000,000	360,000	861,000	1,506,000	2,298,000	5,043,000
(Ha.)	30,000	ST	4,500,000					

LT Long term loans 90% recovery over 5 years

ST Short term loans 90% recovery each year.

Summary of Aid Loan (5 Years)

Item	1	2	3	4	5	Total
1) Loan	800,000	762,000	789,000	798,000	-	3,149,000
2) Sub-Loans	800,000	500,000	1,850,000	2,600,000	-	6,500,000
3) Reflows	-	360,000	861,000	1,506,000	2,298,000	5,000,000
4) Loans outstanding	800,000	1,690,000	2,679,000	3,773,000	1,450,000	-
5) Interest Reloaned	-	48,000	75,000	111,000	156,000	390,000
6) Sub-loan capitalization 10%	-	80,000	125,000	140,000	260,000	650,000

Annex N° 6

Diesel Powered Electrification for the Chapare: An Interim Approach

1. Summary of the Study

A study and report entitled "Proyecto de Pre-Factibilidad para la Electrificación de Centros Poblados del Chapare" was prepared by Walter C. Ellis of OAS and José Villanueva of ELFEC dated 1979 and is referred to as the Project Chapare Plan. This plan identified 22 population centers in the Chapare area and selected II to be given priority for electrification. At the time of the study, electrification for Chapare had a low priority. The writers of the report realized that electrification might be a long time in the future so it recommended the installation of several small diesel generator sets (25-100 KW), one each for the priority centers and the distribution of electric power at the generated voltage of 220/380V. This was to provide electricity with minimum investment until a permanent electrification plan could be undertaken. These small systems would be operated and maintained by local personnel plus an experienced mechanic. The diesels would be operated about 18 hrs. a day.

The priority centers, and size of diesel proposed are listed below:

Center	Diesel
Chipiriri	25 KW
Chimoré	25 KW
Puerto Villarroel	100 KW
Villa 14 de Septiembre	100 KW
Eterazama	25 KW
San Miguel	25 KW
San Francisco	25 KW
Ibuelo	50 KW
Ivirgarzama	25 KW
Paracti	25 KW
Villa Tunari	100 KW

2. Relation to ENDE/ELFIL Project

The Plan Chapare report provided the basis for selecting the priority centers which ELFEC included in its first stage plan. The centers that were omitted were at extremes of ELFEC's proposed circuits but according to ELFEC they will be considered during the next electrification stage. In the event ELFEC does not extend its lines to these remote centers in a future project, small diesels might be considered as an alternative. However, multiple generator units should be installed and 24 hour service provided.

3. Diesel Power Plants Vs. Other Technologies

The use of heavy duty diesel power plants for the Chapare has little merit in the face of the large amount of hydro-electric power from ENDE/ ELFEC near by. In fact, the existence of the hydro plants effectively eliminates most other forms of power as a practical solution for meeting electric energy needs in the Chapare area. Small diesel plants such as proposed in the Proyecto Chapare report might be useful as an interim power source. However, they have relatively short economic lives for continuous electric service of about 10 years. Even though small they need the attention of at least semi-skilled mechanics and operators.

The plan proposed in the Proyecto Chapare report estimated the cost to be US $ 602,059, of which US $ 436,488 was for imports and US $ 165,571 was local costs. The profit and loss projection using ELFIC's standard electric rates showed a total loss of over US $ 479,000 for a 5 year period.

The major benefit of these small units in an utility system is for load building. In an unserved area a small diesel will encourage the wiring of houses and hopefully the development of load. Once the load

grows sufficently to justify bringing in a circuit, the diesel and related installation are retired. However, this is not always the case. With the small diesel, the service is limited and often unreliable, discouraging the use of electricity and the community fails to gain the expected benefits.

ENDE/ELFEC PROJECT FOR ELECTRIFICATION OF THE CHAPARE

1. Introduction

Electric power for the Department of Cochabamba including Cochabamba City and Chapare area is the responsibility of two organizations. Empresa Nacional de Electricidad (ENDE) and Empresa de Luz y Fuerza Eléctrica Cochabamba.(ELFEC).

ENDE is a public corporation with responsibility to develop, manage and operate primary generation and transmission systems in the country with the exception of the Department of La Paz and some sections of the Department of Oruro. Its principal plants are the 30 MVA Corani Hyelectric plant being expanded to 45 MVA and the 45 MVA Sarta Isabel Hydroelectric plant being expanded to 67.5 MVA. Both these plants are near the western end of the Chapare area at a distance of about 65 Km, straight line from Villa Tunari.

ELFEC is also a public corporation of which ENDE is a share holder. ENDE supplies all ELFEC's electric energy. ELFEC has the responsibility to distribute electric power in the City and Department of Cochabamba which includes the Chapare area.

Both ENDE and ELFEC are headquartered in the City of Cochabamba.

2. ENDE-ELFEC Project

To serve the Chapare area ENDE plans to construct a 69 KV substransmission circuit about 65 Km.long from Corani to Villa Tunari. A 5 MVA, 69/24.9 KV distribution substation will be erected at Villa Tunari. A distribution system will be constructed by ELFEC. The primary circuits will be 24.9/14.4KV with 380/220 Volt secundaries which is ELFEC's standard system based on U.S. type at rural electric construction.

ENDE and ELFEC have joined together is seeking financing from IDB for both the power supply and the distribution system. ENDE is taking the leadership in these negotiations which are currently (October 1979) expected to be completed by the end of the year (December 1979). Included in the plan are provisions for ELFEC to wire houses so they will be able to receive electric power when it is available.

ELFEC's current estimate of the time of construction is 10 months.

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However other events need to be included to determine when electric power can be expected in the Chapare. After discussions with ELFEC, the following schedule appears reasonable once the IDB financing is approved:

Loan Agreement and Approvals	4 mo.
Design, including surveying, plans and specifications for procurement	4 mo.
Procurement and delivery	6 mo.
Construction	10 mo.
Total estimated time	24 mo.

Therefore, under this ENDE/ELFEC plan, if a loan is authorized in December 1979, electrification of the Chapare would be ready about December, 1981. It is expected that ENDE would perfom the transmission on a similar schedule.

ELEFEC's plan for the Chapare is shown on "Figure No. 1". The "zones" shown on the diagram are ELFEC references and have no relation to the zones established for the Chapare Development Program except by coincidence. This diagram shows the area planned for electrification. The zones represent areas of service possible from the corresponding distribution circuit. However the total area will be

developed in two stages. The first stage for which the IDB financing is being requested is shown on "Figure No.2".

Included in ELFEC's Chapare electrification plan is street lighting for the principal centers and house wiring for customers to be served under this project.

Once the project is completed ELFEC will manage, operate and maintain the system. They plan to open an office, probably in Villa Tunari, to handle the day to day work, read meters, do minor repairs, and make household connections.

3. Evaluation of ENDE-ELFEC Project

There is nothing new or unusual in this project. Both ENDE and ELFEC have had considerable experience in carrying out such work in the past and should have few problems. The equipment, material and apparatus required would be standard and readily available, much of it off-the-shelf. The design and standards for the 69KV subtransmission and substation by ENDE and the distribution by ELFEC were established under former projects financed by AID.

Poles can be supplied indigenously but most of the rest will

be imported. Their important sources are Argentina, Brasil and USA.

While initially only the population centers would be electrified; ELFEC can serve consumers along the 14.4/24.9KV circuits and run tap lines to residential and industrial or commercial establishments with in a few kilometers of the primary circuits. Such connections are the usual development and growth of a new electric system and are usually at the expense of the customer.

The proposed electrification scheme shown in "Figure No.2" will be extending the distribution circuits to near the limit considered for good service at the ends of the lines. This could affect industrial or commercial installations requiring more than 50 KW. In this event, ELFEC should be consulted so they can check the voltage drop and line regulation. Generally siting large power users close to a distribution substation, as planned for Villa Tunari, improves performance. In the future when the lines will be extended to Puerto Villarroel it will probably be necessary for ENDE to extend its substransmission and install a second distribution substation beyond Chimoré.

4. Funding and Administrative Arrangements

Since the electrification of the Chapare is to be undertaken jointly by ENDE and ELFEC on a high priority basis and they are reasonably assured of IDB financing, there will be no need of additional financing by AID.

The supporting material and negotiations for the IDB loan will be carried through by ENDE with support from ELFEC. ENDE will administer the construction, operation and maintenance of the 69KV substransmission line and distribution substation. ELFEC will administer the construction, operation and maintenance of the distribution system, install . street lighting, connect customers and wire houses. After the work is done ELFEC will run the busines: of the distribution system.

Annex N° 8

Assumptions Used in Developing Monthly Labor Requirements for Present Cropping System

To estimate the monthly labor requirements given in Tables III B-6 and III B-6a it was necessary to make several assumptions. The purpose of this Annex is to outline those assumptions.

The crucial assumption used in developing the above tables concerned: 1) the amount of land cleared per year by the farmer 2) the division of the area classified as planted in "other" crops, and 3) the classification of the perennials into age distributions, that reflect different labor requirements.

With respect to the first assumption, the amount of land cleared each year, this was assumed to be either one hectare per year or one-half of the rice area planted, whichever was greater. This level of clearing was assumed because the given amount would permit a 4-5 year fallow period in the case of a 10 hectare farm and based upon informed opinion in the Chapare this is the normal fallow period for Chapare farmers. In accordance with the usual practice in the Chapare, rice was assumed to be the first crop which was planted in the newly cleared land.

Concerning the second assumption, the classification of the area planted in other crops, not specified, the area was assumed to be planted in the following category of crops; 1) yuca 2) annual crops labeled "other annual" and 3) perennial crops labeled "other perennial". Concerning the division of land among the above three classes, the following was assumed;

Area in Hectares

Crop Emphasis Area	Yuca	Other Annual	Other Peronnial
Rubber	0.34	0.40	0.40
Tea	0.38	0.30	0.30
Piña	0.33	0.35	0.35
Cacao	0.33	0.40	0.40
Pejivalle	0.28	0.40	0.40

The area planted to yuca was assumed to be equally divided between area planted this year and available for harvest next year and area planted the previous year and available for harvest this year.

The labor coefficients used to estimate monthly labor requirements for the crop(s) classified as "other annual" were taken from the soybean labor data in Table III B-5. The coefficients for the crop(s) classified as 'other perennial" were taken from the papaya labor information in the same table.

Concerning the assumption on the age distribution of perennials it was decided to classify all perennials into three catogories. The three categories used for the age distribution of the perennials were the following; A) area planted in current year B) area planted in previous years but not yet in production and C) area planted in previous years and now in production.

Using the above classification, the assumptions on the age distribution of the present perennials is, by area, as follows:

1. Average Chapare Farm

Crop	Classification A	Classification B	Classification C
Banana	0.15 ha.	-	0.51 ha.
Coca	0.16 ha.	-	0.50 ha.
Citrus	-	0.37 ha.	0.19 ha.
Other Perennial	-	-	0.40 ha.

2. Rubber Area

Crop	Classification A	Classification B	Classification C
Banana	0.15 ha.	-	0.74 ha.
Coca	0.27 ha.	-	0.50 ha.
Citrus	-	0.44 ha.	0.22 ha.
Other Perennial	-	-	0.40 ha.

3. Tea Area

Crop	Classification A	Classification B	Classification C
Banana	0.08 ha.	-	0.38 ha.
Coca	0.25 ha.	-	0.79 ha
Citrus	-	0.50 ha.	0.25 ha.
Other Perennial	-	-	0.30 ha.

4. Cacao Area

Crop	Classification A	Classification B	Classification C
Banana	0.18 ha.	-	0.60 ha.
Coca	0.10 ha.	-	0.31 ha.
Citrus	-	0.25 ha.	0.13 ha.
Other Perennial	-	-	0.40 ha.

5. Pineapple Area

Crop	Classification A	Classification B	Classification C
Banana	0.05 ha.	-	0.16 ha.
Coca	0.10 ha	-	0.40 ha
Citrus	-	0.13 ha.	0.07 ha.
Other Perennial	-	-	0.35 ha.

6. Pejivalle Area

Crop	Classification A	Classification B	Classification C
Banana	0.15 ha.	-	0.51 ha.
Coca	0.15 ha.	-	0.46 ha.
Citrus	-	0.36 ha.	0.19 ha
Other Perennial	-	-	0.40 ha.

The above estimates were developed in an attempt to provide a realistic labor use pattern for average farm situations in the various programs, given knowledge about the plantings of the various perennials and knowledge concerning the time required for the various perennials to come into production.

A N N E X No. 9

Labor Requirements for New Crops and Rotation System

This annex presents the back-up tables associated with summary tables III B6-a and III B6-b shown in the text. The tables in this annex are of two kinds: (1) those presenting the farm level monthly and annual labor requirement for each new crop and livestock activity from the initiation of the activity untill attainment of its targeted level (Tables 1, 2, 4, 6, 8 and 10); and (2) the estimated annual and monthly family labor balance for an average farm in each of the commodity program areas, assuming the addition of the new cropping and livestock activities (Tables 3, 5, 7, 9 and 11) without any substitution for current cropping.

TABLE No. 1

Crop Rotation, Forage and Livestock Monthly and Annual Labor Requirements from Initiation of the Activity to Attainment to Targeted Levels

System	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
							Year 1						
Crop Rotation	-	-	-	0.60	0.70	0.60	3.00	4.80	6.70	5.70	3.80	-	25.90
Forage	-	-	-	-	-	-	-	-	-	3.00	-	-	3.00
Livestock	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	0.60	0.70	0.60	3.00	4.80	6.70	8.70	3.80	-	28.90
							Year 2						
Crop Rotation	6.00	7.00	6.00	0.60	0.70	0.60	3.00	4.80	6.70	5.70	3.80	-	44.90
Forage	-	-	0.50	1.00	1.00	1.00	1.00	1.00	1.00	4.00	0.50	-	11.00
Livestock	-	-	-	-	-	-	-	-	-	-	4.00	4.00	8.00
Total	6.00	7.00	6.50	1.60	1.70	1.60	4.00	5.80	7.70	9.70	8.30	4.00	63.90

TABLE No. 1 (cont'd)

Crop Rotation, Forage and Livestock Monthly and Annual Labor Requirements from Initiation of the Activity to Attainment to Targeted Levels

System	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
Year 3													
Crop Rotation	6.00	7.00	6.00	0.60	0.70	0.60	3.00	4.80	6.70	5.70	3.80	-	44.90
Forage	-	-	0.50	1.00	1.00	1.00	1.00	1.00	1.00	4.00	0.50	-	11.00
Livestock	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	24.00
Total	8.00	9.00	8.50	3.60	3.70	3.60	6.00	7.80	9.70	11.70	6.30	2.00	79.90
Year 4													
Crop Rotation	6.00	7.00	6.00	0.60	0.70	0.60	3.00	4.80	6.70	5.70	3.80	-	44.90
Forage	-	-	0.50	1.00	1.00	1.00	1.00	1.00	1.00	4.00	0.50	-	11.00
Livestock	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	48.00
Total	10.00	11.00	10.50	5.60	5.70	5.60	8.00	9.80	11.70	13.70	8.30	4.00	103.90

TABLE No. 2

Farm Level Monthly and Annual Labor Requirements for the Rubber Activity from Initiation of the Activity to Attainment of Targeted Levels

	Years						
	1	2	3	4	5	6	7
July	-	4,0	-	-	-	7,0	14,0
Aug	-	-	-	-	-	7,0	14,0
Sept	10,0	10,0	-	-	-	7,0	14,0
Oct	10,0	17,5	15,0	15,0	7,5	7,0	14,0
Nov	15,0	22,5	15,0	15,0	22,0	29,0	29,0
Dec	18,0	25,5	15,0	15,0	22,0	29,0	29,0
Jan	19,0	26,5	15,0	15,0	14,5	14,0	14,0
Feb	22,0	29,5	15,0	15,0	14,5	14,0	14,0
Mar	8,0	15,5	15,0	15,0	22,0	29,0	29,0
April	7,0	7,0	-	-	14,5	29,0	29,0
May	8,0	8,0	-	-	7,0	14,0	14,0
June	4,0	4,0	-	-	7,0	14,0	14,0
Total	121,0	170,0	90,0	90,0	131,0	200,0	228,0

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TABLE No. 3

Annual and Monthly Family Labor Balance for an Average Farm in the Rubber Program Areas with the Addition of the New Cropping Activities

(years)

	0	1	2	3	4	5	6	7
July	+ 12.78	- 1.22	- 11.22	+ 4.78	+ 18.38	+ 17.78	+ 13.48	+ 1.58
August	+ 5.73	- 8.27	- 15.27	- 3.27	+ 10.23	+ 9.73	+ 5.43	- 2.07
Sept	+ 20.64	+ 6.64	+ 0.14	+ 12.14	+ 15.64	+ 15.14	+ 10.84	+ 3.34
Oct	+ 26.32	+ 15.72	+ 8.29	+ 8.78	+ 8.29	+ 15.29	+ 20.49	+ 12.99
Nov	+ 18.96	+ 3.26	- 2.04	+ 3.46	+ 2.96	- 4.54	- 6.84	- 7.34
Dec	+ 10.17	- 8.43	- 13.73	- 5.23	- 5.73	- 13.23	- 15.33	- 16.03
Jan	+ 22.75	+ 0.75	- 2.62	+ 6.88	+ 6.38	+ 6.38	+ 11.58	+ 11.08
Feb	+ 16.87	- 9.93	- 15.43	- 2.93	- 3.43	- 3.43	+ 1.77	+ 1.27
Mar	+ 5.73	- 8.97	- 14.47	- 15.97	- 16.47	- 23.97	- 26.27	- 26.77
April	+ 17.17	+ 1.47	+ 0.47	+ 5.47	+ 5.97	- 10.03	- 26.23	- 26.73
May	+ 27.97	+ 16.17	+ 11.67	+ 21.67	+ 21.17	+ 13.67	+ 1.37	+ 0.87
June	+ 8.61	- 9.39	+ 0.61	+ 20.61	+ 20.11	+ 12.61	- 0.49	- 0.99
Balance	+ 193.70	- 2.20	- 53.60	+ 56.89	+ 83.40	+ 35.40	- 10.20	- 48.56

TABLE No. 4

Farm Level Monthly and Annual Labor Requirements for the Tea Activity from Initiation of the Activity to Attainment of Targeted Levels

	Years											
	1	2	3	4	5	6	7	8	9	10	11	12
July	7.00	-	-	4.00	8.00	-	17.00	17.00	-	21.00	21.00	-
August	7.00	2.00	2.00	6.00	10.00	2.00	19.00	19.00	2.00	23.00	23.00	2.00
September	7.00	2.00	2.00	6.00	10.00	2.00	19.00	19.00	2.00	23.00	23.00	2.00
October	3.00	10.75	5.75	11.75	18.25	5.75	22.75	22.75	5.75	22.75	22.75	5.75
November	4.00	8.75	7.75	11.75	18.75	20.75	20.75	20.75	24.75	24.75	24.75	24.75
December	8.50	10.25	9.25	13.25	20.25	22.25	22.25	22.25	26.25	26.25	26.25	26.25
January	11.00	5.75	9.95	13.75	20.75	22.75	22.75	22.75	26.75	26.75	26.75	26.75
February	11.00	7.25	11.25	15.25	22.25	24.25	24.25	24.25	28.25	28.25	28.25	28.25
March	7.00	5.75	9.75	13.75	20.75	22.75	22.75	22.75	26.75	26.75	26.75	26.75
April	4.50	2.00	6.00	10.00	17.00	19.00	19.00	19.00	23.00	23.00	23.00	23.00
May	-	-	4.00	8.00	5.00	17.00	17.00	5.00	21.00	21.00	5.00	21.00
June	-	-	4.00	8.00	5.00	17.00	17.00	5.00	21.00	21.00	5.00	21.00
Total	70.00	54.50	71.50	121.50	176.00	175.50	243.50	219.50	207.50	287.50	255.50	207.50

TABLE No. 5

Annual and Monthly Family Labor Balance for an Average Farm in the Tea Program Areas with the Addition of the New Cropping Activities

Years

	0	1	2	3	4	5	6	7	8	9
July	+ 17.82	+ 10.82	+ 11.82	- 9.82	+17.82	+13.82	+21.82	+ 4.82	+ 4.82	+21.82
Aug	+ 10.87	+ 3.87	+ 1.87	- 0.13	+ 7.87	+ 3.87	+11.87	- 5.13	- 5.13	+11.87
Sept	+ 18.03	+ 16.03	+ 9.53	+ 7.53	+ 5.53	+ 1.53	+ 9.53	- 7.47	- 7.47	+ 9.53
Oct	+ 27.93	+ 24.33	+ 15.58	+18.58	+10.58	+ 4.08	+16.58	- 0.42	- 0.42	+16.58
Nov	+ 18.87	+ 14.17	+ 8.42	+ 7.42	+ 1.42	- 5.58	- 7.58	- 7.58	- 7.58	-11.58
Dec	+ 9.94	+ 0.84	- 1.91	- 2.91	- 8.91	-15.91	-17.91	- 17.91	-17.91	-21.91
Jan	+ 26.91	+ 12.91	+ 17.16	+11.61	+ 5.16	- 1.84	- 3.84	- 3.84	- 3.84	- 7.84
Feb	+ 16.47	+ 0.67	+ 3.42	- 2.58	- 8.58	-15.58	-17.58	- 17.58	-17.58	-21.58
Mar	+ 4.25	- 9.45	- 9.20	-15.20	-21.20	-28.20	-30.20	- 30.20	-30.20	-34.20
Apr	+ 21.06	+ 7.86	+ 9.36	+ 3.36	- 2.64	- 9.64	-11.64	- 11.64	-11.64	-15.64
May	+ 25.15	+ 21.35	+ 16.85	+14.85	+ 8.85	+11.85	- 0.15	- 0.15	+11.85	- 4.15
June	+ 2.88	+ 2.88	- 1.12	+10.88	+ 4.88	+ 7.88	- 4.12	- 4.12	+ 7.88	- 8.12
Balance	+200.18	+106.28	+ 81.78	+43.59	+20.78	-33.72	-33.22	-101.22	-77.22	-65.22

TABLE No. 6

Farm Level Cacao Labor Requirements by Month and Year From Initiation of the Activity to Attainment of Tarjet Levels

	Years											
	1	2	3	4	5	6	7	8	9	10	11	12
July	7.00	10.75	12.50	13.50	16.25	12.50	12.50	15.00	18.75	20.75	22.25	23.25
August	7.00	7.00	7.00	7.00	7.00	2.00	4.50	7.50	11.00	14.50	16.00	17.00
September	2.00	4.25	6.50	8.75	11.00	13.25	15.75	18.75	22.25	25.75	27.25	28.25
October	2.50	5.00	7.00	9.00	11.00	10.50	10.00	10.00	10.00	10.00	10.00	10.00
November	3.50	7.25	9.25	9.25	9.25	5.75	2.00	-	-	-	-	-
December	4.00	7.75	9.75	9.75	9.75	5.75	2.00	-	-	-	-	-
January	1.50	4.00	6.00	8.00	10.00	10.50	10.00	10.00	10.00	10.00	10.00	10.00
February	-	-	-	-	-	-	-	-	-	-	-	-
March	4.75	8.50	11.75	14.00	16.25	14.75	13.25	11.25	11.25	11.25	11.25	11.25
April	3.50	7.00	11.00	13.00	17.00	18.00	19.50	21.00	24.50	26.00	27.00	27.50
May	-	-	-	-	2.00	4.50	7.50	11.00	14.50	16.00	17.00	17.50
June	6.25	10.00	13.00	17.75	23.00	21.50	24.00	28.75	30.75	32.25	33.25	33.75
Total	42.00	71.50	93.75	110.00	132.50	119.00	121.00	133.25	153.00	166.50	174.00	178.50

TABLE No. 7

Annual and Monthly Family Labor Balance for an Average Farm in the Cacao Program Areas, with the Addition of the New Cropping Activities

	Years												
	0	1	2	3	4	5	6	7	8	9	10	11	12
July	+ 22.51	+ 15.51	+ 5.76	+ 2.01	+14.41	+11.66	+15.41	+15.41	+12.91	+ 9.16	+ 7.16	+ 5.66	+ 4.66
August	+ 17.54	+ 10.54	+ 3.54	+ 1.54	+14.94	+14.94	+19.94	+17.44	+14.44	+10.94	+ 7.44	+ 5.94	+ 4.94
September	+ 27.13	+ 25.13	+ 16.38	+12.13	+12.28	+10.03	+ 7.78	+ 5.28	+ 2.28	- 1.22	- 4.72	- 6.22	- 7.22
October	+ 25.92	+ 22.82	+ 19.32	+15.32	+11.32	+ 9.32	+ 9.82	+10.32	+10.32	+10.32	+10.32	+10.32	+10.32
November	+ 18.52	+ 14.32	+ 9.57	+ 5.57	+ 3.57	+ 3.57	+ 7.07	+10.82	+12.82	+12.82	+12.82	+12.82	+12.82
December	+ 13.73	+ 9.13	+ 4.38	+ 0.38	- 1.62	- 1.62	+ 2.38	+ 6.13	+ 8.13	+ 8.13	+ 8.13	+ 8.13	+ 8.13
January	+ 23.21	+ 18.71	+ 15.21	+11.21	+ 7.21	+ 5.21	+ 4.71	+ 5.21	+ 5.21	+ 5.21	+ 5.21	+ 5.21	+ 5.21
February	+ 14.12	+ 9.32	+ 8.32	+ 6.32	+ 4.32	+ 4°32	+ 4.32	+ 4.32	+ 4.32	+ 4.32	+ 4.32	+ 4.32	+ 4.32
March	+ 3.96	- 7.49	- 12.24	-17.49	-21.74	-23.99	-22.49	-20.99	-18.99	-18.99	-18.99	-18.99	-18.99
April	+ 16.23	+ 4.03	- 0.47	- 6.47	-10.47	-14.47	-15.47	-16.97	-18.47	-21.97	-23.47	-24.47	-24.97
May	+ 35.74	+ 31.94	+ 27.44	+29.44	+27.44	+25.44	+22.94	+19.94	+16.44	+12.94	+11.56	+10.44	+ 9.94
June	- 16.86	+ 10.61	+ 2.86	+17.26	+10.51	+ 5.26	+ 6.75	+ 4.56	- 0.19	- 2.19	- 3.69	- 4.69	- 5.19
Balance	+235.47	+164.57	+100.07	+77.22	+72.17	+49.67	+63.17	+61.97	+49.22	+29.47	+16.09	+.8.47	+ 3.97

TABLE No. 8

Per Farm Pineapple Labor Requirements by Month and Year From Initiation of the Activity to Attainment of Targeted Levels

	Years								
	1	2	3	4	5	6	7	8	9
uly	-	2.00	0.20	0.20	0.20	2.00	0.20	0.20	0.20
ugust	-	2.50	1.00	1.20	1.20	2.50	1.00	1.20	1.20
eptember	-	2.50	1.00	1.00	1.00	2.50	1.00	1.00	1.00
ctober	-	2.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00
ovember	-	-	40.00	40.00	40.00	-	40.00	40.00	40.00
ecember	-	-	40.00	40.00	40.00	-	40.00	40.00	40.00
anuary	-	2.20	40.00	40.00	40.00	2.20	40.00	40.00	40.00
ebruary	17.50	2.20	2.00	2.00	17.50	2.20	2.00	2.00	17.50
arch	18.50	2.40	2.00	2.00	18.50	2.40	2.00	2.00	18.50
pril	18.50	2.40	2.50	2.50	18.50	2.40	2.50	2.50	18.50
ay	17.50	2.40	2.60	2.60	17.50	2.40	2.60	2.60	17.50
une	2.00	0.40	2.50	2.50	2.00	0.40	2.50	2.50	2.00
otal	74.00	21.00	134.80	135.00	197.40	21.00	134.80	135.00	197.40

TABLE No. 9

Annual and Monthly Family Labor Balance For and Average Farm in the Pineapple Program Areas with the Addition of the New Cropping Activities

	Years					
	0	1	2	3	4	5
July	+ 26.24	+ 26.24	+ 22.24	+ 18.14	+ 31.64	+ 31.14
August	+ 22.18	+ 22.18	+ 17.43	+ 12.68	+ 26.08	+ 25.58
September	+ 30.62	+ 30.62	+ 25.87	+ 21.62	+ 25.12	+ 24.62
October	+ 33.73	+ 33.43	+ 31.13	+ 29.63	+ 29.13	+ 28.63
November	+ 26.83	+ 26.48	+ 25.13	+ 3.13	+ 2.63	+ 2.13
December	+ 23.22	+ 22.92	+ 21.62	- 0.38	- 0.88	- 1.38
January	+ 31.43	+ 29.93	+ 26.33	+ 5.43	+ 4.93	+ 4.43
February	+ 24.14	+ 12.99	+ 17.24	+ 15.34	+ 14.84	- 2.16
March	+ 17.32	+ 4.72	+ 8.42	+ 6.62	+ 6.12	- 11.88
April	+ 29.98	+ 14.88	+ 19.08	+ 17.03	+ 16.53	- 1.22
May	+ 36.99	+ 26.34	+ 27.49	+ 29.39	+ 28.89	+ 12.19
June	+ 18.84	+ 17.84	+ 14.64	+ 29.59	+ 29.09	+ 27.84
Balance	+321.52	+268.57	+256.62	+188.22	+214.12	+139.92

TABLE No. 10

Per Farm Pejivalle Labor Requirements by Month and Year From Initiation of the Activities to Attainment of Target Levels

Month	Years 1	2	3	4
July	10.00	7.50	7.50	10.50
August	10.00	-	-	3.00
September	8.00	-	-	3.00
October	2.00	-	-	3.00
November	2.00	7.50	10.50	10.50
December	8.00	7.50	10.50	10.50
January	15.50	-	3.00	3.00
February	7.50	7.50	10.50	10.50
March	7.50	7.50	10.50	10.50
April	7.50	-	3.00	3.00
May	-	7.50	10.50	10.50
June	7.50	7.50	10.50	10.50
Total	85.50	52.50	76.50	88.50

TABLE No. 11

Annual and Monthly Family Labor Balance for an Average Farm in the Pejivalle Program Areas with the Addition of the New Cropping Activities

Month	Years 0	1	2	3	4
July	+ 19.27	+ 9.27	+ 5.77	+ 3.77	+ 12.77
August	+ 12.92	+ 2.92	+ 5.92	+ 3.92	+ 11.92
September	+ 24.61	+ 16.61	+ 18.11	+ 16.11	+ 15.11
October	+ 29.34	+ 26.74	+ 27.74	+ 25.74	+ 20.74
November	+ 21.47	+ 18.77	+ 12.27	+ 7.27	+ 5.27
December	+ 15.02	+ 6.42	+ 5.92	+ 0.92	- 1.08
January	+ 25.97	+ 7.47	+ 21.97	+ 16.97	+ 14.97
February	+ 19.32	+ 7.02	+ 7.02	+ 1.02	- 0.98
March	+ 10.71	- 3.49	- 4.49	- 9.49	- 11.49
April	+ 21.75	+ 5.55	+ 12.05	+ 7.05	+ 5.05
May	+ 30.67	+ 26.87	+ 14.87	+ 13.87	+ 11.87
June	+ 12.44	+ 4.84	+ 0.94	+ 12.94	+ 10.94
Balance	+243.49	+128.99	+128.09	+100.09	+ 95.09

T A B L E Nº 1
BENEFITS COST ANALYSIS
Basic Schedule of Costs by Project Year
(US Dollars)

Activity	Project Years One	Two	Three	Four	Five	Seven	TOTALS
Development Authority	1.117.500	1.045.568	1.007.525	1.023.786	1.124.869	-	5.319,248
Research and Extension	2.180.000	1.453.000	1.489.000	1.592.000	714.000	-	7.428.000
Roads	3.762.500	2.128.300	2.084.800	2.306.500	2.538.000	-	12.820.100
Communi-cations	166.500	59.100	59.100	59.100	59.100	-	403.000
Credit	495.700	405.600	285.600	265.600	-	-	1.452.500
Electricity and Water	88.676	39.977	-	-	185.347	-	314.000
Agribusiness Yuca	350.000	-	-	-	-	-	350.000
Farm Supply	100.000	-	-	-	-	-	100.000
Box Factory	50.000	-	-	-	-	-	50.000
Vertically Int. Corps -Tea	530.000	-	-	-	-	-	530.000
Rubber	78.600	80.600	182.600	176.600	176.600	1.050.000	1.745.000
Cacao	220.450	991.750	2.591.750	91.750	91.750	-	3.987.450
TOTALS:	9.140.026	6.203.895	7.700.375	5.515.336	4.889.666	1.050.000	34.499.299

TABLE Nº 2

Basic Schedule of Net Benefits, by Project Year
(US Dollars)

Proyect Year	Swine	Cattle	Citrus	Pejivalle	Pineapple	Other Crops*
1	30.932	-	-	-	45.000	-
2	264.219	-	-	-	180.000	20.000
3	660.548	200.000	122.500	240.000	585.000	65.000
4	1.453.205	600.000	245.000	600.000	1.800.000	200.000
5	2.510.081	1.140.000	367.500	960.000	2.250.000	250.000
6	2.642.190	1.200.000	490.000	1.200.000	2.340.000	260.000
7	2.686.227	1.222.000	580.000	1.260.000	2.430.000	270.000
8	2.730.263	1.240.000	610.000	1.320.000	2.520.000	280.000
9	2.774,300	1.260.000	625.000	1.380.000	2.610.000	290.000
10	2.818.336	1.280.000	640.000	1.440.000	2.700.000	300.000
11	2.862.373	1.300.000	665.000	1.500.000	2.790.000	310.000
12	2.906.409	1.320.000	670.000	1.560.000	2.880.000	320.000
13	2.950.446	1.340.000	685.000	1.620.000	2.970.000	330.000
14	2.994.482	1.360.000	700.000	1.680.000	3.060.000	340.000
15	3.038.519	1.380.000	715.000	1.740.000	3.150.000	350.000
TOTALS:	33.322.530	14.840.000	7.115.000	16.500.000	32.310.000	3.585.000

* Anticipated increases in yiels for rice, corn, vegetables, root crops, papaya, bananas and other product lines not listed in other columns of this table, as a result of use legume ground cover.

TABLE Nº 2 (continuation)

Basic Schedule of Net Benefits, by Project Year

(US Dollars)

Project Year	Rubber	Tea	Cacao	Reduction of Losses	TOTAL BENEFITS
1	-	-	-	-	75.932
2	-	-	306.000	-	770.219
3	-	39.000	918.000	200.000	3.030.048
4	-	57.000	1.938.000	400.000	7.293.205
5	-	87.000	3.468.000	525.700	11.558.281
6	-	129.000	5.100.000	561.150	13.922.340
7	-	175.500	5.100.000	597.750	14.319.477
8	-	225.000	5.100.000	636.275	14.661.538
9	-	225.000	5.100.000	676.000	14.940.300
10	70.000	225.000	5.100.000	718.575	15.291.911
11	320.000	225.000	5.100.000	762.450	15.834.823
12	700.000	225.000	5.100.000	808.500	16.489.909
13	1.150.000	225.000	5.100.000	856.800	17.227.246
14	1.300.000	225.000	5.100.000	906.500	17.665.982
15	1.428.000	225.000	5.100.000	959.500	18.086.019
TOTALS:	4.968.000	2.287.500	57.630.000	8.609.200	181.167.230

TABLE Nº 3

Adoption of New Technology (Number of Farms and Cumulative Hectares) by Project Year and by Activity 1/

Project Year	Legume Swine (Ave.Net.Bene.US$2.102 x ha) Nº Acceptors	Legume Swine Nº Hectares	Legume Cattle (at $1.000 per ha.) Nº Acceptors	Legume Cattle Nº Hectares	Legume Citrus (at $ 100 per ha.) Nº Acceptors	Legume Citrus Nº Hectares
1	15	30	-	-	-	-
2	60	120	-	-	-	-
3	150	300	100	200	600	1225
4	330	660	300	600	1000	2450
5	570	1140	570	1040	1500	3675
6	600	1200	600	1200	2000	4900
7	610	1220	610	1220	3000	5800
8	620	1240	620	1240	3200	6100
9	630	1260	630	1260	3300	6250
10	640	1280	640	1280	3400	6400
11	650	1300	650	1300	3500	6650
12	660	1320	660	1320	3600	6700
13	670	1340	670	1340	3700	6850
14	680	1360	680	1360	3800	7000
15	690	1380	690	1380	3900	7150

1/ - Average net benefits may be lower during first years of production.

- Adoption rates for years 6 to 15 were arrived at on an ad-hoc, but conservative basis.

TABLE N° 3 (Continuation)

Adoption of New Technology (Number of Farms and Cumulative Hectares) by Project Year and by Activity. 1/

Project Year	Legume Pejivalle (at $ 1.200 per ha.) N°Acceptors	N°Hectares	Legume Pineapple (at $ 9.000 per ha.) N°Acceptors	N°Hectares	Legume Other Crops 2/ (at $ 1.000 per ha.) N°Acceptors	N°Hectares
1	-	-	10	5		
2	-	-	40	20	20	20
3	200	200	130	65	65	65
4	500	500	400	200	200	200
5	800	800	500	250	250	250
6	1000	1000	520	260	260	260
7	1050	1050	540	270	270	270
8	1100	1100	560	280	280	280
9	1150	1150	580	290	290	290
10	1200	1200	600	300	300	300
11	1250	1250	620	310	310	310
12	1300	1300	640	320	320	320
13	1350	1350	660	330	330	330
14	1400	1350	680	340	340	340
15	1450	1450	700	350	350	350

1/ - Average net benefits may be lower during first years of production.
- Adoption rates for years 6 to 15 were arrived at on an ad-hoc, but conservative basis.

2/ All other crops such as bananas, yuca, platanos, etc. which benefit from legume ground cover and/or other project activities such as the dehydration plant discussed in the agribusiness section.

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TABLE N° 3 (Continuation)

Adoption of New Technology (Number of Farms and Cumulative Hectares) by Project Year and by Activity. 1/

Project Year	Legume Rubber (at $ 714 per ha.)		Legume Tea (at $ 750 per ha.)		Legume Cacao (at $ 1,020 per ha.)	
	N° Acceptors	N° Hectares	N° Acceptors	N° Hectares	N° Acceptors	N° Hectares
1	-	-	-	-	-	-
2	100	200	152	76	600	300
3	400	800	232	116	1200	900
4	700	1400	344	172	2000	1900
5	1000	2000	468	234	2000	2900
6	1000	2000	600	300	2000	4600
7	1000	2000	600	300	2000	5000
8	1000	2000	600	300	2000	5000
9	1000	2000	600	300	2000	5000
10	1000	2000	600	300	2000	5000
11	1000	2000	600	300	2000	5000
12	1000	2000	600	300	2000	5000
13	1000	2000	600	300	2000	5000
14	1000	2000	600	300	2000	5000
15	1000	2000	600	300	2000	5000

1/ - Average net benefits may be lower during first years of production.

- Adoption rates for years 6 to 15 were arrived at on an ad-hoc, but conservative basis.

TABLE Nº 3 (Continuation)

Adoption of New Technology (Number of Farms and Cumulative Hectares) by Project Year and by Activity.

Project Year	Total Acceptors	Total Hectares
1	25	35
2	972	736
3	3.077	3.869
4	5.774	8.082
5	7.658	12.289
6	8.580	15.720
7	9.680	17.130
8	9.980	17.540
9	10.180	17.800
10	10.380	18.060
11	10.580	18.420
12	10.780	18.580
13	10.980	18.840
14	11.180	19.050
15	11.380	19.360