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Bolivia Agroindustrial Marketing Systems Study

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October 1990

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BOLIVIA AGROINDUSTRIAL MARKETING SYSTEMS STUDY

Submitted to:

U.S. Agency for International Development

La Paz, Bolivia

by:

The Agricultural Marketing Improvement Strategies Project

(AMIS)

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ACRONYMS USED IN THIS REPORT

ASAR	Asociacion de Servicios Artesanales Y Rurales
ASOBOFLOR	Asociacion Boliviana de Exportadores de Flores
CEDEAGRO	Centro de Desarrollo Agropecuario
CESO	Canadian Executive Service Overseas
CORDECO	Corporation Regional de Desarrollo de Cochabamba
CORDECRUZ	Corporation Regional de Desarrollo de Santa Cruz
CRDP	Chapare Regional Development Project
DIRECO	Direccion de Reconversion
FEPC	Federacion de Empresarios Privados de Cochabamba
FOCAS	Formación de Capital en Areas Secundarias
IBTA	Instituto Bolivano de Tecnologia Agricola
IESC	International Executive Service Corps
INE	Instituto Nacional de Estadistica
INPEX	Instituto Nacional de Promoción de Exportaciones
JUNAC	Junta de Acuerdo de Cartagena
NGO	Non-Governmental Organization
PDAC	Proyecto de Desarrollo Alternativo de Cochabamba
PIDYS	Plan Integral de Desarrollo Y Sustitucion
PROCIPLA	Programa de Control Integrado de Plagas
PRODES	Proyecto de Desarrollo y Sustitucion
PRODEVE	Proyecto de Desarrollo Viticula
SEASA	Servicios de Envasado Aseptico S.A.
SUBDESAL	Subsecretario de Desarrollo Alternativo
UCF	Unidad Crediticia Y Financiera
UNFDAC	United National Fund for Drug Abuse Control
UMSS	Universidad Mayor de San Simon

EXECUTIVE SUMMARY

Efforts over the last ten years to promote the development of alternatives to coca production in both the Chapare and Valles Altos regions of Bolivia have achieved only limited success. Although the high price of coca leaf has been until recently a major obstacle to the adoption of new crops, it has become increasingly clear that the lack of adequate marketing systems has also been a key factor.

In late 1989, therefore, USAID La Paz signed a contract with the Washington-based Agricultural Marketing Improvement Strategies Project (AMIS) to undertake a series of actions focused upon the problem of marketing system development. These actions included:

1. A Rapid Appraisal of the existing marketing system within Bolivia, particularly with respect to agroindustrial production, to identify areas of strength and weakness within the system and provide recommendations for system improvement.

2. The selection of a short-list of existing and potential agricultural products appearing to possess prima facie market potential, and the undertaking of national, regional and international market studies to determine demand, prices, product requirements and likely competition from other sources.

3. The initiation of contacts with medium and large-scale North American agribusiness operations to canvass their support for the development of U.S./Bolivian linkages in agroindustrial production and marketing, and to determine private sector requirements for such involvement.

Each one of these aspects will constitute the basis for a written report to USAID La Paz. The present volume deals specifically with the Rapid Appraisal of the existing agroindustrial marketing system described in (1) above, but also reviews possible products for inclusion in the marketing study under (2).

The Setting

The two regions, the Chapare and the Valles Altos, represent significantly different agro-climatic zones. The Chapare, at the Eastern base of the Andes, occupies some 2.5 million hectares of humid tropical lowlands ranging in altitude from 200-1200 metres (the majority in the lower zones) with rainfall averaging around 4,000mm/annum. The Valles Altos, by contrast, comprise several interconnected semi-arid valleys extending over almost 1 million hectares, most of which falls within the range of 1,500-2,500 metres in height. The Valles Altos region is now in its fourth year of below average rainfall and crop failure in non-irrigated areas is common.

Due largely to the economic importance of coca, the Chapare has been the more dynamic of the two regions and in the last two decades has attracted a considerable number of settlers, many from the Valles Altos. Demographic data is scarce but estimates place the population of the Chapare in excess of 300,000 persons, with some 30,000-40,000 farm families (many landless individuals are employed as labourers in the coca industry).

Total population of the Valles Altos is probably little more than 80,000, of which many are seasonal migrants, returning only to the Valleys during the brief rainy season to assist their families in land preparation and planting.

Current Marketing System

The current marketing system from both target areas is characterized by a lack of specialized marketing infrastructure (e.g. post-harvest treatments, packaging, modified transport) or well defined linkages between different participants in the marketing system. Participants at all levels of the system lack confidence in the ability of subsequent stages to provide secure markets for their goods (i.e. producer/transporter/ wholesaler/processor/packager/shipper). As a result, few participants are willing to invest in specialist infrastructure, fearing that payback is uncertain and difficult.

Post-harvest losses are high -- approaching or exceeding 20% for the more delicate fruits and vegetables -- while marketing margins are considerable, probably largely a result of the risks faced by participants that markets will not be found for the products. A survey of marketing margins over the last 10-12 years reveals no clear trends in margins over this time.

Although intermediaries play a significant role in handling output of the Valles Altos (but not in the Chapare) they do not appear to control production through harvest-linked production loans, as is the case in many Latin American countries. Existing agroindustrial uses for production from the two regions is minimal. Limited processing of pineapples, tumbo, and some spices does occur, usually with the processor buying at the factory gate.

Raw Materials

Potential materials for the processing sector can be divided into three groups - traditional products, non-traditional products and new products (the last being crops that have not yet achieved commercial scale production).

Traditional products encompass the following crops:

Chapare	Valles Alto
Orange	Potato
Mandarin	Maize
Grapefruit	Wheat
Banana	Tomato
Plantain	Peanut
Yuca	
Papaya	

Non-traditional crops include:

Pineapple	Grape
Turmeric	Cumin
Ginger	Cherimoya
Achiote	Avocado
Tea	
Coffee	
Lemon Grass	
Cocoa	

New crops identified as potential raw material sources included:

Passion Fruit	Tumbo
Carambola	Prickly Pear
Naranjilla	Anise
Soursop	Oregano
Black Pepper	Culanthro
Cardamom	Garlic
Cayenne Pepper	Jalapeño Pepper
Allspice	Cochineal
Mint	Olives
Freshwater Shrimp	Eucalyptus
Spearmint	
Macadamia	

Broadly, the identified products can be divided into six groups: Herbs & Spices; Flavourings & Colorants; Tropical Fruits; Citrus; Commodities, and; Others (the last including those products not fitting within a general category).

Accessing Raw Materials

Due to the precipitous decline in coca leaf prices in late 1989 and early 1990, farmer responsiveness to alternative crops is high. Even if coca leaf prices do recover, it is likely that farmers in the Chapare will not want to repeat their current almost total dependency upon leaf as a source of income. Valles Altos growers have long sought alternatives to their limited range of current crops.

Extensive production holdings by agroindustrial firms within either of the two areas appears unlikely under current policies and legislation. Although parcels of up to 1,000 hectares probably could be assembled, this is often inferior land. Better possibilities may exist in the Chapare, however, as coca lands go out of production the lack of previous experience of Bolivian agroindustrial firms in farm and plantation management would also suggest that direct supervision of outgrower farms could only be achieved after considerable investment and supply management expertise. The participation of a foreign company with experience in this area might make this a more feasible proposition, however.

In the absence of either of the above two options, agroindustrial firms will likely have to rely on producer groups, cooperatives or local associations to manage raw material supply. These groups exist but currently lack membership, management expertise or technical skills for this task. The development of a major agroindustrial sector in Bolivia may well require significant attention to the strengthening of such groups, as well as to post-harvest extension services to growers.

The Processing Sector

The agroindustrial sector is not a major player in the Bolivian economy. A low population base, combined with lack of demand and fierce competition from imports (often entering as contraband), has resulted in few firms managing to achieve a significant size. Even these firms are often part of larger holding companies or industrial consortia.

The majority of agroindustrial enterprises in Bolivia are family enterprises, with both facilities and management often being provided from the home of the owner.

The handful of larger companies appear to possess adequate capital for investment and some new processing technologies have been adopted. Lack of confidence in the domestic supply system, however, linked to low import costs, has led many companies to rely almost exclusively upon foreign materials. A number of key technologies are not represented among the major Bolivian agroindustrial processors, including Individual Quick Frozen (IQF) technology. Similarly, no dedicated major processors of animal feeds or tomato processors (as opposed to packagers) were identified. While these companies advertise extensively in local markets, no significant export of Bolivian agroindustrial products occurs.

The smaller processors possess a number of strengths, including entrepreneurial behaviour, usage of local raw materials where possible, eagerness to learn about and adopt new technologies, and a generally good standard of workmanship. Weaknesses included extremely primitive or antiquated technologies, poor management practices, limited financial resources, and an almost total ignorance of marketing methods beyond their local environment. The inclusion of such enterprises within a strategy of sectoral development will require careful attention to such areas as financial management, human resources development and technology transfer.

Quality of export products will be important if Bolivia is to attract and maintain international buyers. Quality assurance and product analysis thus become key considerations. While no commercial facilities exist, Agroquimico (a non-profit joint-venture based in Cochabamba), as well as several university departments in the major cities, have this capability to some extent. The development of a dynamic export sector will require, however, the development of increased QA facilities and capabilities.

Packaging and Storage

The disorganized nature of the agricultural marketing system, combined with the low level of demand in Bolivia, has led to packaging materials being expensive and available only in a limited range of materials and types. With the exception of wood for crates, no packaging raw materials are manufactured in Bolivia (including paper, cardboard, plastic, glass or metal) and local packaging manufacturers are mostly limited to rolling, crimping, extruding and blowing raw materials imported from neighbouring countries. Production runs often tend to be short, thus increasing per unit costs for the manufacturer and client.

Despite these drawbacks, some materials are readily available, including atoxic plastics for liquid packaging, and high-density polyethylene for bulk packaging. Glass and metal containers must be rejected for export use due to their cost and only bulk packaging appears cost effective at this point.

Bulk packaging of pulps, pastes, concentrated juices and other perishable semi-liquids can be achieved economically using a bag-in-box system (large plastic drums are available only at a high price), but the absence of locally available aseptic packaging materials means that the use of a cold chain would be necessary. It does appear that a cold chain could be established (see below) but its cost and reliability have as yet to be tested. Aseptic packaging might be an option for larger processing operations but both the technology and materials would have to be imported, raising serious concerns over the additional cost margin that would be involved.

One of the larger agroindustrial companies in Bolivia has recently introduced the Swedish Tetra-Pak system, which provides retail package-sized aseptic containers for fruit drinks. Unfortunately, local demand does not appear adequate to maintain the system at a reasonable utilization rate and the export of ready-to-drink packets, with their high water content, appears doubtful.

Commercial storage space, either ambient or controlled temperature, is almost non-existent, even at the international airports. Even manufacturers (especially the artesanal ones) have limited on-site storage available. Cold storage facilities can be constructed locally, however, and at reasonable cost, as can refrigerated trucks for local transport. Refrigerated containers (reefers) for export of perishable products can be carried by local transporters but would have to be brought in from outside by the exporter. Any attempt to develop the marketing system for perishable products would almost certainly require the construction of some commercially available storage space, particularly at points of shipment (airports, truck loading points, etc.)

The recent establishment of a dry ice manufacturing facility in Cochabamba is an encouraging development. The ready and economical availability of dry ice may considerably increase the feasibility of storing and shipping frozen processed product (see below).

Infrastructure and Transport

Cochabamba and Santa Cruz (the two principal cities in the area) can both provide all normal infrastructural facilities of a large city, although electricity is expensive. Infrastructure in the two producing areas of Chapare and the High Valleys, however, is almost non-existent with limited or no electricity, water supply or communications.

The Chapare region is served by an asphalt road for most of the distance between Cochabamba and Santa Cruz (with Chapare in the middle). The remaining sections will be paved in the near future. Feeder roads are graded but generally maintained in reasonable condition. Access to most of the Valles Altos region has been upgraded significantly in recent years, although some parts are still difficult to reach. Feeder roads are few and of poor quality.

Local transport is widely available but normally completely unspecialized. Truckers will not invest in specialized vehicles or facilities unless there are customers willing to pay a higher price for goods transported under such a system. Combined with the limited use of packaging materials and poor roads in some areas, delivery of raw materials can pose a serious problem where quality is paramount. There are indications, however, that incentives would change this pattern rapidly. Current delivery costs to Cochabamba average US$10-20/ton from the Valles Altos and US$7-10/ton from the Chapare.

International transport is available by air, road and rail, with the likelihood that barge traffic on the Paraguay river to Uruguay and Argentina may be available in the near future (this route was inaugurated for bulk soybeans in December of 1989). Lloyd Air Boliviano (LAB) offers extremely attractive incentive freight rates to North America and neighbouring countries (including Miami for as little as US$0.37/Kg.) but space may be limited. Rates offered by other carriers are more expensive but include reasonable costs to Europe (approximately US$1.70-1.80/Kg.).

Road transport to the Pacific coast requires approximately 2-3 days, delivering the cargo to Chile (Arica or Iquique) or Peru (Matarani) at costs in the region of US$50-60/ton, although rates are negotiable to a considerable extent. Trailer units capable of handling containers are readily available. Refrigerated cargoes would probably attract a 60-75% cost premium, raising their cost to US$80-

100/ton. In addition, exporters face the problem of bringing the refrigerated container to Cochabamba, which means arranging a backhaul in order to reduce cost. The recent availability of dry ice in Cochabamba may revolutionize the international shipment of frozen processed product by permitting the use of insulated containers or trucks not equipped with cooling equipment.

Rail transport is also available at approximately the same cost as road transport, perhaps more cheaply for major cargoes. The national railway system (ENFER) offers considerable storage space but is notorious for the slowness of cargo movements. Anecdotal accounts of Bolivia-Pacific coast transfers occupying up to one month were commonly cited.

Legal and Fiscal Aspects

As in any country, agroindustrial operations are subject to a variety of taxes, both on sales (Value Added Tax) and on imputed profits. A limited tax on assets also applies.

Export documentation procedures have been complicated in the past but were simplified under Presidential order in January 1990. These modifications are only just being introduced now so it is difficult to say whether they are of real help. A number of export incentives are offered by the government, including compensation for VAT and duties paid on inputs as well as a Duties Compensation Payment, that amounts to a 10% incentive payment of most exports.

Bolivia probably has one of the best foreign investment climates in Latin America. The law guarantees that no discrimination will be applied against foreign investors as well as assuring investors of free movement of capital, fees, dividends and profits into and out of the country. A recently introduced Investment Code strengthens and expands upon these protections. Foreign exchange rate stability is a key priority of the government after the disastrous period of hyperinflation in the mid-1980s and the exchange rate has declined by only 7% over the last 18 months.

A key weakness for local exporters, especially smaller ones, is the absence of an effective export promotion agency that can provide information on market opportunities, standards, specifications, export shipment and similar areas of concern to exporters. The existing agency, INPEX, has proven to be a disappointment and USAID has withdrawn its funding.

Key Opportunities and Constraints to Agroindustrial Development

The study identified overall a number of key opportunities and constraints to agroindustrial development within Bolivia. These are listed briefly below and discussed in more detail in the conclusions to the study (Section 9).

Opportunities:

RAW MATERIAL AVAILABILITY

- The agronomic potential of the Chapare appears high, despite poor soils in some areas.
- There may be unexploited crop opportunities in Valles Altos.
- Some raw materials are available at extremely low cost.

ACCESSING RAW MATERIALS

- Strong interest appears to exist in diversifying away from coca.
- Labour availability is good and costs are low.
- Producer groups are already in place for some products.
- A number of active NGOs are present in the agricultural sector.
- The traditional sindicato structure suggests the ability of producers to develop well organized supply groups.
- Resources exist for technical and credit support of new crops.

PROCESSING FACILITIES AND CAPABILITIES

- Cochabamba and Santa Cruz contain a considerable number of innovative entrepreneurial small-scale producers.
- Considerable idle capacity exists in most larger agro-processing operations.
- Some local processing technology has already been developed.
- Some capability already exists for processing research and quality assurance.
- Concessional financing may be available through USAID and UNDP programs.

PACKAGING AND STORAGE

- Certain bulk packaging materials exist at relatively low cost.
- Local capacity exists to construct cold-storage facilities.
- It is possible to establish a cold-chain to the Pacific ports.

INFRASTRUCTURE AND TRANSPORT

- Infrastructure availability in Cochabamba and Santa Cruz is good.
- Good main road access exists to the Chapare region and access to the Valles Altos is being improved.
- Air freight is possible at reasonable prices direct from Cochabamba.
- Transporters appear responsive to new patterns of demand.

LEGAL AND FISCAL ASPECTS

- Exchange rate stability is good.
- Export industries are encouraged and export incentives are offered.
- Bolivia receives favourable customs treatment from many industrialized countries.
- The government guarantees equal treatment and free movement of funds to foreign investors.

Constraints:

RAW MATERIAL AVAILABILITY

- Many of the most promising crops are not in commercial production.
- Irrigation potential appears poor for most of the Valles Altos.
- Soil erosion and degradation risks may exist for high-altitude areas in the Chapare.

ACCESSING RAW MATERIALS

- There is limited use, or knowledge, of procedures to produce export quality output.
- Land tenure systems may impede the establishment of large nucleus farms.
- Most producer organizations have only small memberships and limited management skills.
- Current post-harvest handling systems are rudimentary at best.

PROCESSING FACILITIES AND CAPABILITIES

- Existing technology is generally rudimentary.
- The agroindustrial sector has almost no experience of exporting.
- Commercial financing is difficult to obtain and expensive.
- Almost all machinery and equipment must be imported.

PACKAGING AND STORAGE

- All packaging raw materials are imported.
- Consumer-size packaging is extremely expensive per unit volume.
- Commercially available cold-storage space does not exist.
- Aseptic packaging methods will probably only be economically feasible for large-scale processing operations.

INFRASTRUCTURE AND TRANSPORT

- Basic infrastructure is lacking in both producing areas.
- Existing road access to parts of the Valles Altos is extremely poor.
- Local transport systems are not adapted to perishable cargo transport.
- Non-air freight export products must bear cost of transport to the coast.
- Air freight space is limited.

LEGAL AND FISCAL ASPECTS

- Export documentation is still cumbersome and lengthy.
- Bolivia lacks an effective export information and promotion service.

Recommendations for Marketing System Improvement

RAW MATERIAL AVAILABILITY

- Increased knowledge of agronomic potentials/constraints associated with non--traditional and 'new' crops, especially in the Valles Altos
- Improved availability of appropriate planting materials for selected crops (i.e. varieties suited to processing)

ACCESSING RAW MATERIALS

- Improved extension services (reaching a far greater number of growers) linked to processor needs
- Strengthened producers' and growers' associations, particularly in areas of financial and administrative management

- Improved knowledge of post-harvest handling requirements, both on farm and in delivery to the plant

PROCESSING FACILITIES

- Attention to improving the technological and quality standards of smaller processors
- Easing of access by processors to capital and working funds

PACKAGING AND STORAGE

- Focus upon the identification and development (if feasible) of lower-cost aseptic packaging processes, to reduce dependency upon refrigerated transport
- Development of commercially available chill and cold store facilities, especially at transhipment points such as airports

INFRASTRUCTURE & TRANSPORT

- Education of transport operators in requirements for transporting perishable and fragile goods
- Improvement in infrastructure in producing areas (to power cold storage and pre-processing operations)
- Continued efforts to upgrade road quality in the Valles Altos

LEGAL AND FISCAL ASPECTS

- Continued attention to reduction in paperwork associated with exports
- Restructuring of INPEX, or creation of alternative exporters' assistance centre

Specific Implementation Activities

The study identifies a number of areas where specific actions could be taken by USAID, in association with the Government of Bolivia, to alleviate constraints within the agroindustrial marketing system. Recommendations are limited, however, by the fact that the report is the first of three deliverables under the AMIS Bolivia buy-in.

The findings of the subsequent market studies, and especially the planned contacts with North American agribusiness firms, are expected to significantly affect the direction and extent of future actions.

For the purposes of presenting such recommendations in a logical fashion, they have been divided below into short-term and long-term recommendations.

1. SHORT-TERM ACTIONS

   a) Realistic financial feasibility appraisals will be required for those crops identified as exhibiting strong export potential. The existence of market demand is not in itself sufficient to justify promotion of export development activities; it must be matched by evidence that the product can be produced at a price that the market is willing to pay. This evidence we do not yet possess.

      Where international agribusiness firms can be persuaded to investigate joint-venture potentials, such an appraisal may be undertaken largely or wholly at their expense and

effort. It is certain, however, that other cases will be identified where, although there is no immediate joint-venture potential, there are importers with an interest in purchasing the product - perhaps on a long-term contract arrangement. In this case the lack of financial appraisals would deny Bolivian producers and exporters the confidence to exploit these markets, as well as the ability to seek and obtain necessary funding and technical assistance to undertake the effort in an effective manner.

b) Where development is to occur independently of specific investment-based joint-ventures, discussions must also be held with other interested groups in Bolivia to determine their ability and interest in cooperating in export development activities. These groups may include the producers' groups UN412 Program, Agroquimico (quality control), and individual processors and packagers. Both USAID and PDAC should be represented in such discussions.

c) Several areas were tentatively identified in this study that could not be explored further for lack of specific technical expertise. It is suggested that USAID consider carefully the value of contracting one or more specialists in pharmaceutical plants to evaluate the potential of Bolivia as a supplier to world markets in this area. The list of natural extracts (in addition to essential oils and colorants) being derived from plants is enormous, and most possess both a very high value for weight ratio, and a limited range of natural distribution.

2. LONG-TERM ACTIONS

A number of areas which would benefit from long-term action are readily apparent from this study. These areas are discussed below:

a) The reliable supply of product to processors and packagers requires institutional strengthening of producer groups and farmers' associations. Assistance would be needed in adminstration, financial management, communications and extension

b) Post-harvest extension services are currently not available in the Department of Cochabamba. Attention should be given to extending the activities of IBTA Chapare and that of groups in the Valles Altos so that post-harvest technologies and practices can be taught to producers, traders and small-scale processors.

c) Specific technical and administrative assistance is needed by the smaller agroindustrial firms operating in Cochabamba. USAID could explore a number of options for achieving this including work with Alternative Technologies Inc., the Executive Volunteer Service of the U.S.A. as well as the placement of a long-term contractor in Cochabamba to coordinate such efforts and provide on-going support.

d) Plant propagation and nursery facilities will require extensive improvement and upgrading. Current facilities will simply be unable to meet the needs of any significant export production program. In addition, there are no general nursery facilities at all in the Valles Altos.

e) Depending upon the products selected for export development, there is likely to exist an urgent need for expanded storage facilities, particularly at major transport nodes such as airports and key wholesale markets.

f) Current efforts in local roads improvement should continue.

1.0 INTRODUCTION

1.1 Historical Setting

The cultivation of the coca bush (Erythroxylon sp.) has been a feature of agriculture in the Andes region of South America for thousands of years. Traditional production, centred in Bolivia in the Yungas valleys to the East of La Paz, has long provided coca leaf to labourers working in the agricultural and mining sectors. Chewed during work, the leaves provide a mild euphoric effect that is believed to facilitate oxygen uptake by the body and increase stamina at high altitudes.

In the 1970s international demand began to increase rapidly for cocaine, the processed active ingredient derived from coca. While increased production did occur in the Yungas valleys in response to this demand, limitations on available land and labour led to the initiation of large-scale production in the Amazonian foothills area of the Department of Cochabamba. Previously largely unsettled, this area - known as the Chapare - experienced a rapid growth in population and economic activity during the 1970s. Estimates quoted in Rasnake and Painter (1989; p.14) placed total population in 1967 at less than 25,000 for the whole Chapare region, while by 1981 some 400,000 people passed in and out of the region.

A series of events occurred in the first half of the 1980s that greatly increased this growth and the consequent economic importance of coca production to the Bolivian economy. Firstly, a coup in 1981 led by General Luis Garcia Meza, resulted in support to the cocaine industry by high level government officials and set back early attempts to control growth in the sector.

Secondly, severe drought in 1982 and 1983 led to increased population movements by campesinos suffering from failed harvests. With no other sources of income available to them, many of these campesinos were forced to seek wage labour in the rapidly growing Chapare economy.

Thirdly, the international price of tin, a key Bolivian foreign exchange earner since the beginning of the century, suffered a severe decline and eventually almost total collapse in 1985, when the International Tin Council failed, leading to a cessation of tin trading on the London Metal Exchange. The effect of this failure on the Bolivian economy was catastrophic. Many mines were closed, resulting in severe unemployment and a sudden increase in population outflow from the altiplano region where the mining sector is concentrated. The consequent steep decline in demand for foodstuffs by mining communities led, in turn, to a diminished demand for agricultural production and falling prices for produce.

Finally, poorly conceived economic policies of the then government (including, in 1983, the delinking of the Bolivian peso from the U.S dollar), together with the impact of the drought and the collapse of world tin prices, led to hyperinflation in 1984. With annual rates of inflation approaching 15,000% (Rasnake & Painter, 1989; p.8), the economy was pushed strongly towards an increased dependence on the remaining sources of hard currency earnings, including coca paste.

By the second half of the 1980s, the cocaine industry was believed to account for a significant proportion, perhaps even the majority, of total GDP.

1.2 USAID and the Development of Alternatives to Coca

Although USAID was first active in the Chapare region as early as 1965, with the construction of access roads, the problem of non-traditional coca production was not addressed until the late 1970s when funding was provided for PRODES (Development and Substitution project) activities in both the Chapare and the Yungas.

Efforts were effectively halted during the government of General Garcia but resumed again in 1983 with the establishment of the Chapare regional development project (CRDP). However, security concerns and the lack of effective government control over the Chapare area led to lengthy delays in program commencement.

With world prices for cocaine reaching unprecedented levels, however, providing financially attractive alternatives to coca production proved extremely difficult. In early 1986, therefore, attention was turned to the Distrito Sur and some neighbouring valleys in the Department of Cochabamba; referred to by USAID as the Associated High Valleys (Valles Altos). A traditional source of out-migration since the time of the Spanish conquest, this area of semi-arid inter-montane valleys is claimed to have provided as much as 80% of the population flow into the Chapare region (IBTA Chapare Annual Report, 1989; p.192). The argument was therefore put forward that reduced growth of coca production in the Chapare was dependent, at least in part, on the provision of economic alternatives to out-migration for residents of the Valles Altos.

Under the Program for the Alternative Development of Cochabamba (PDAC), formed in 1987 with USAID funding, attention was thus to be divided between the Chapare and the Valles Altos. In both cases, the focus was to be upon the identification and development of alternative agricultural and agroindustrial activities that could provide substitutes for employment in the coca sector.

These efforts were to be overseen by SUBDESAL (Subsecretariat for Alternative Development), an organization formed under the Ministry of Agriculture and Peasant Affairs, and backed up by government legislation. The legislation, passed in June of 1988, declared coca production illegal outside of traditional producing areas (i.e. the Yungas valleys) and allowed growers in the Chapare a maximum of ten years to phase out production. To provide some incentives to growers to comply, a U.S.$2,000 payment per hectare was offered through DIRECO (the National Reconversion Directorate) to growers who voluntarily eliminated existing coca plantations. An estimated 35,000 hectares (84,000 acres) in the Chapare was expected to be affected by this legislation (Rasnake & Painter, 1989; p.22). Concessional loans were also available to those converting from cocoa into other crops.

1.3 The Role of Marketing in Coca Replacement

The establishment of the PDAC and the offering of conversion bonuses, has led to a considerable increase in development activity in both the Chapare and the Valles Altos. This activity has been aided by a recent substantial decline in coca leaf prices (see Section 2.2).

One aspect of the new activity has been increased USAID support to the activities of IBTA Chapare, the government agricultural research and extension organization responsible for the area. This support has funded varietal and field testing of new crops and the promotion, through extension staff, of promising alternative crops.

On a small scale, this work is already bearing fruit. At the time of preparation of this report (March/April 1990), growers in the Chapare are harvesting an estimated 60 MT of Ginger and are expected to harvest another 200 MT of Turmeric within the next three months. Progress has been slower in the Valles Altos, partially as a result of continued drought conditions in this region. Nevertheless, USAID funding to a range of NGOs (see Section 2.3) has resulted in some progress in the area.

Development activities have been impeded, however, by a growing realization that purely agronomic and infrastructural development will not necessarily guarantee attractive financial returns to growers working with crops other than coca. For a new crop or activity to be viable, markets must exist that will provide an outlet for such production at prices that provide the growers with an adequate return to their labour and other inputs.

The expenditure by USAID of large sums on the development and promotion of alternatives which have no market potential would result in further setbacks to substitution efforts, the wasting of considerable sums of assistance financing and, perhaps even more importantly, the real risk of losing the confidence of growers who have made the often difficult decision to abandon coca cultivation (or remain in the Valles Altos in the face of attractive wages elsewhere).

With a dispersed and relatively poor population, adequate domestic demand in Bolivia for new products, or new forms of traditional products, can not be taken for granted. Strong competition also exists from legally and illegally imported products from such neighbouring countries as Brazil and Chile.

Internationally, Bolivia faces a number of disadvantages including lack of export experience (Bolivia has no significant agricultural exports), the lack of a seacoast, and a poorly developed agroindustrial sector.

These factors suggest strongly that the development of viable alternatives to coca will require careful attention to market feasibility. Already the PDAC is committed to purchasing the current harvest of ginger because the domestic market appears unable to absorb more than 20% of this extremely limited output.

In late 1989, therefore, USAID La Paz signed a contract with the Washington-based Agricultural Marketing Improvement Strategies Project (AMIS) to undertake a series of actions focused upon the problem of marketing system development. These actions included:

1. A Rapid Appraisal of the existing marketing system within Bolivia, particularly with respect to agroindustrial production, to identify areas of strength and weakness within the system and provide recommendations for system improvement.

2. The selection of a short-list of existing and potential agricultural products appearing to possess prima facie market potential, and the undertaking of national, regional and

international market studies to determine demand, prices, product requirements and likely competition from other sources.

3. The initiation of contacts with medium and large-scale North American agribusiness operations to canvass their support for the development of U.S./Bolivian linkages in agroindustrial production and marketing, and to determine private sector requirements for such involvement.

Each one of these aspects will constitute the basis for a written report to USAID La Paz. The present volume deals specifically with the Rapid Appraisal of the existing agroindustrial marketing system described in (1) above.

1.4 Rapid Appraisal Activities and the AMIS Project

Established in late 1987 with funding from the Bureau of Science and Technology, USAID, in Washington, the 5-year Agricultural Marketing Improvement Strategies (AMIS) project provides a vehicle for the assessment and improvement of agricultural marketing systems world-wide.

While the tasks undertaken by AMIS staff cover a wide spectrum of activities within the agricultural marketing sector, areas of focus can be divided broadly into three areas:

- Rapid Appraisals; comprising short-term (1-3 month) analyses or diagnoses of existing systems to determine key constraints and opportunities in marketing system functioning and development

- Applied Research; medium-term (3-12 month) detailed investigations of identified problems in marketing system operations, and the development of recommendations for corrective actions

- Pilot Innovations; medium-term (3-12 month) applications of formulated approaches to marketing system improvement, often as a pilot for subsequent large-scale project implementation

Of the three project activities described in Section 1.3 above, only the first output - the assessment of the existing agroindustrial marketing system - fits clearly within any of these categories (as a Rapid Appraisal). However, both the market assessments and the agribusiness contacts can be seen as types of Rapid Appraisal activity in that they attempt to develop a rapid assessment of needs and potentials in a particular aspect of agricultural marketing.

The implementation of the system appraisal described in the attached report follows many standard procedures of a classic Rapid Appraisal. Nevertheless, the focus on agroindustrial activity has led to some differences from the approach described in the AMIS handbook (Holtzman et al, 1988). The following features common to all Rapid Appraisals have been followed:

- Focus upon use of secondary data sources where possible to minimise field time and cost

- Participation of staff from key national institutions to develop in-country awareness of RA methodology

- Emphasis upon interviews with active system participants, especially where statistically reliable data is lacking

- Identification of overall system structure and functioning

- Formulation of recommendations for system improvement or further research

Differences under the current contract from the standard AMIS approach include:

- Reduced emphasis upon traders and a greater input from participants in processing, packaging and transport

- The need to anticipate possible future constraints due to the limited extent of current agroindustrial marketing activity

- The separation of demand analysis into a separate task (the market studies)

- Framing of the report such that it will be of use not only to USAID and PDAC staff, but also to private sector agribusiness firms considering involvement in Bolivia through purchase of product, technical assistance or joint-venture investment

Finally, it should be noted that the Marketing System Rapid Appraisal team received support from local consultants through the preparation of associated reports that have been incorporated into the main report (Volume II). These studies, covering processing operations and equipment, packaging operations and facilities, transport, and legal and fiscal factors, are provided in full in the attached annexes. Although it was originally intended that some or all of these consultants would work with the team in the field, this proved impossible for budgetary reasons. Nevertheless, their contribution in assembling and analyzing background information is gratefully acknowledged.

The Rapid Appraisal Team involved in this study included the following AMIS staff:

Aidan Gulliver	-	Team Leader/Ag. Economist
Miguel Jimenez	-	Post-Harvest Specialist

Bolivian personnel involved included:

Ney Lopez	-	Marketing & Credit Specialist (USAID/PDAC)
Carlos Perez	-	Social Anthropologist (USAID/PDAC)
Gustavo Navia	-	Marketing Specialist (PDAC)

The AMIS team wishes to express their particular thanks to Dr. Lopez, without whom the field work would not have been possible. Not only did he undertake much of the logistical work involved in the study, but also contributed significantly to the technical aspects, including through the provision of the material relating to credit and financing in Sections 4.3 and 5.5. Finally, thanks

must also be expressed to management and staff of the PDAC and the USAID Mission to Bolivia, both of whom were instrumental in permitting the AMIS field team to adequately conduct their studies. Among these staff must be mentioned Charles Hash, David Lozano and Darrell McIntyre.

2.0 BACKGROUND

The area for which the PDAC is responsible comprises two separate districts, the Chapare and the Valles Altos, both lying within the Department of Cochabamba and approximately equidistant from the departmental capital of the same name.

Differences of altitude, however, have resulted in the two districts possessing completely different geographical, agricultural and socio-economic characteristics. While the coca producing Chapare, to the ENE of the departmental capital, lies at the foot of the Andes, on the edge of the great Amazonian lowlands, the Valles Altos to the SSE, by contrast, are inter-montane valleys with their highest points extending into the altiplano.

Neither district possesses any significant urban areas, but the principal settlements are often used as points of reference in describing regions within each district; Villa Tunari, Ivirgazama and Puerto Villarroel in the Chapare and Tarata, Mizque, Aiquile and Omereque in the Valles Altos (see Map 2.1)

It is important to note that the availability of reliable data in general in Bolivia tends to be extremely poor, leading to considerable uncertainty over statistical information. The last national population census, for example, was conducted in 1976, while the agricultural census in 1984 provided no data at all on crop production. Data difficulties have been further exacerbated in the Chapare as a result of its rapid spontaneous growth during the last 20 years and the reluctance of many growers to respond truthfully to surveys, fearing the information would be used for narcotics control purposes.

As a result, many statistics are little more than educated guesses on the part of local staff and are frequently contradictory.

2.1 The Natural Setting

2.1.1 Chapare

Although different definitions exist, it is generally accepted that the Chapare comprises an area of approximately 2,500,000 hectares, falling almost entirely in a latitude of between 16° and 17° S, and including terrain extending from approximately 1,400 metres above sea level in the upper reaches of the principal valley, to no more than 200m in Yapacani, in the Department of Santa Cruz. The area over 600-700m is limited, however, and little of it is usable for agriculture due to the steep slopes in the upper valley area.

Agro-climatically, the Chapare can be classified as humid sub-tropical with rainfall fluctuating over the range of 3,000-7,000 mm/yr.(average 3,900mm), with precipitation concentrated in the period December-March. Humidity averages around 75-85% with temperatures normally ranging from 19° to 29°. Southerly winds during the Southern Hemisphere winter (May-August) may occasionally reduce these temperatures to 12° or below.

IBTA Chapare has provisionally divided the Chapare area into 5 ecologically defined subzones, each covering approximately equal sections of the region. Subzone I contains the best soils in the Chapare (neutral alluvial deposits) and is classified as suitable for all crops except coffee. Subzone II comprises the higher altitude soils which are classified as generally good but require some lime and fertilizer applications. Subzone III includes principally steeply sloped lands suitable only for agroforestry and permanent tree crops such as coffee. Subzone IV is primarily low-lying poor sandy soils, with potential only for pineapple (when irrigated), forage crops and pasture. Finally subzone V is classed as protected land, containing riverside and extremely high rainfall areas subject to frequent flooding.

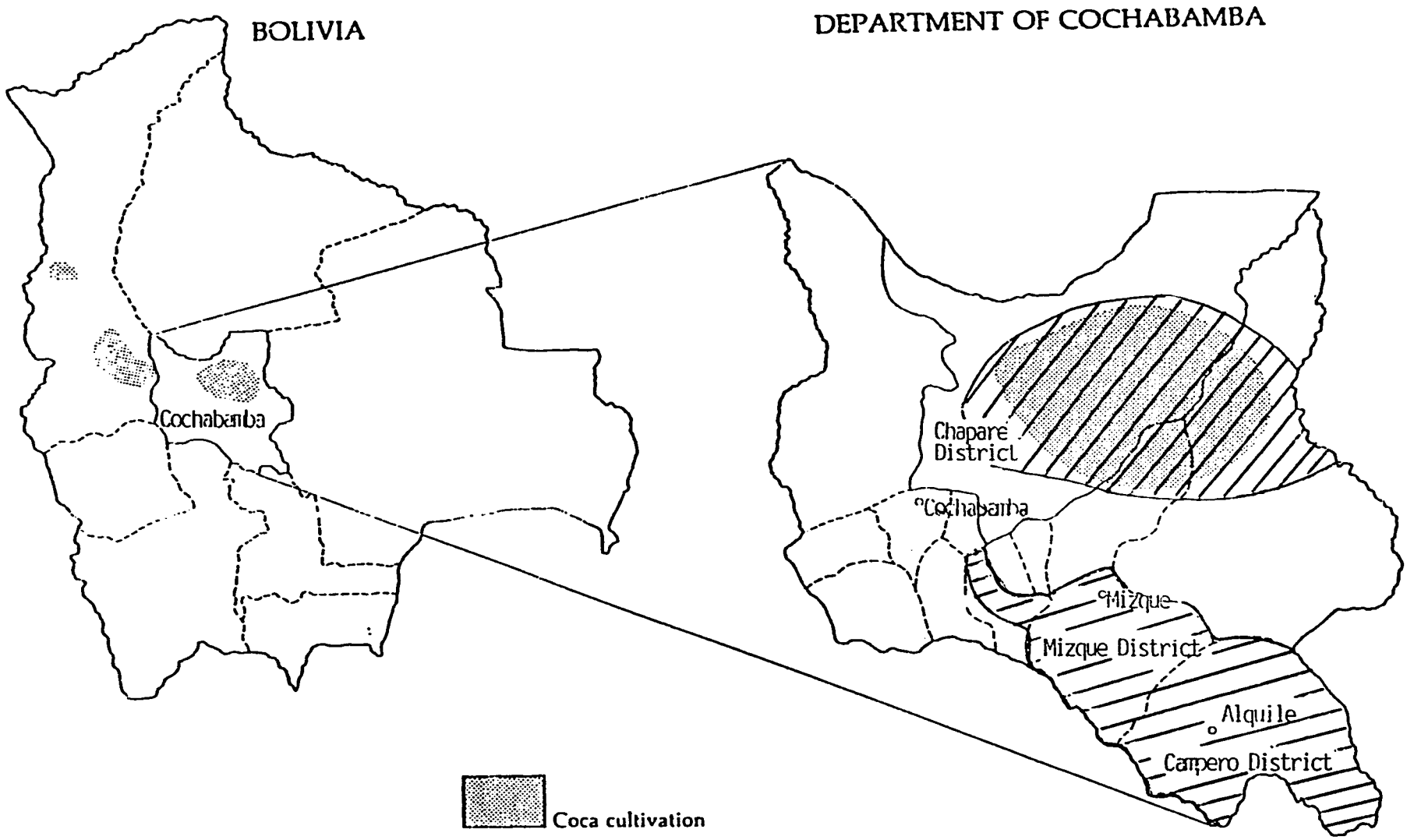
Soil conditions in some of these subzones (particularly III, IV and V) have given rise to serious concerns over the ability of much of the Chapare to support intensive agriculture. With the predominance of alluvial silts subject to leaching from the high precipitation levels, much of the Chapare region suffers a deficiency of Ca, Mg, K and Na, giving rise to aluminium toxicity in some areas and typical pH readings in the region of 4.5-5.5.

2.1.2 Valles Altos

The Valles Altos comprise the entirety of the two provinces of Campero and Mizque and a part of the province of Esteban Arce within the Department of Cochabamba. In total these three areas contain some 950,000 hectares, extending over an altitude range of from 1,100 to 2,900 metres above sea level (the majority of settlements occurring within the 1,750-2500m range).

Rainfall is the key limiting factor in the Valles Altos area. Although precipitation typically averages from 400-475 mm per year, concentrated almost entirely in the November to March period, the district is now in its fourth consecutive year of below average precipitation. Evapotranspiration effects worsen the problem, leading to a water deficit for the region extending over a period of 4-8 months of the year, depending upon the location (DESFIL, 1987; Section 2 p.7). Annual mean temperatures are in the region of 18° with an average high in summer of over 24°. Hail and occasional frosts may occur in the winter (May-August) period, causing crop damage.

Soils vary by district, with those around Aiquile tending to be the poorest, with low to very low organic content and shortages of nitrogen and phosphorous. High pH levels are also encountered. Soils in the other areas tend to have higher organic contents and near neutral or slightly high pH readings.



Map 2.1: Location of the Chapare and Valles Altos Regions, Bolivia

2.2 The Socio-Economic Context

2.2.1 Chapare

Rapidly changing conditions in the Chapare, together with a reluctance to provide information due to fears of anti-narcotic efforts, have led to an almost total lack of reliable demographic data for the region. A consensus of estimates by persons working in the area would place total population somewhere in the region of 30,000-40,000 farm families and in excess of 300,000 individuals (not all employed in agriculture). It must be stressed, however, that these figures are no more than educated guesses, and other estimates ranging from 25,000-75,000 farm families and as many as 500,000 individuals can easily be obtained from other observers.

Although it comprises a single geographic and even economic region, care must be taken not to view the Chapare as a single homogeneous population and society. At least three distinct population groups can be identified in the region, each possessing a different history of entry into the Chapare, a different economic status and a widely divergent social structure.

The first important group within the Chapare comprises the long-established, largely government-sponsored settlers, who first opened up the Chapare to agricultural activities in the years following the 1953 revolution and agrarian reform act. Arriving before the coca boom, these settlers were provided average holdings of some 20 ha per family (IBTA Chapare, 1989) and traditionally supported themselves through subsistence agriculture, logging and seasonal employment in Cochabamba.

Socially, these groups are well organized, having brought with them the sindicato structure from the Valles Altos and Altiplano, and their established status has made them less dependent than other groups upon the coca industry. It is estimated that this group numbered some 25,000 spread among 54 communities in 1967, although the arrival of other groups may already have started by then (Flores and Blanes 1984; p.82).

The second principal group comprises the spontaneous settlers, many of whom arrived in response to the emergence of the coca sector during the 1970s and early 1980s. According to Rasnake & Painter (1989;p.3) this group tended to be wealthier and more entrepreneurial, often possessing sufficient capital to maintain themselves while farm land was cleared and the coca plantations established.

Nevertheless, the newer settlers tend to have smaller holdings, averaging 5-10 hectares (IBTA Chapare, 1989) and are considerably less well organized in social terms than the established settlers. It is from this group that most of the applicants for the U.S.$2,000 coca eradication bonus are drawn, and the tendency has been for applicants to leave the Chapare altogether once payment has been received, either returning to the Valles Altos as comparatively wealthy landowners, or establishing small enterprises in Cochabamba. No accurate estimates exist for this population but given the widely accepted guess of some 30,000-40,000 farm families in the Chapare, and the likely growth in the 'established' farming population, it may be assumed that they comprise some 20,000-30,000 farm families, or approximately 2/3 of those in the Chapare.

The final population group is even harder to quantify or define. Consisting primarily of seasonal migrants, or those who have insufficient capital to establish their own holdings, this

segment of the population provide the vital wage labour for coca harvesting, coca paste preparation, and even agricultural production. Once again, no reliable estimates exist but guesses place their numbers as high as 150,000-200,000 or almost half of the total Chapare population.

No credible data exists for farm income, largely due to the major influence of coca leaf prices on net returns. Agricultural labour is currently paid at the rate of approximately Bs.10/day plus food and coca leaf for chewing, but this rate probably fluctuates according to the demand for pisadores (coca leaf processors) and other manual labour in the coca industry.

2.2.2 Valles Altos

The Valles Altos comprise one of the longest established settlement areas in Bolivia, and have been important since the time of the Spanish conquest as sources of both agricultural production and labour for other parts of the country (particularly the mining sector in the altiplano). The 1976 population census (Instituto Nacional de Estadistica, 1976) calculated the total population covered by the PDAC at 66,579, broken down into approximately 32,000 in the Province of Campero, 27,000 in the Province of Mizque, and 7,500 in the two Cantons of Tarato and Arbieto in the Province of Esteban Arce that fall within the scope of PDAC activities. Extrapolating from projections quoted by Rasnake and Painter (1989; p.25) current population levels are probably in the region of 80,000-85,000, although seasonal outmigration may reduce that population considerably at any one time.

Despite its essentially rural nature - less than 12% of the population was classified as urban in the 1984 Agricultural Census - a 1989 socio-economic survey of the Campero and Mizque provinces undertaken by CORDECO, the Departmental development agency, revealed that less than 30% of the population are able to maintain themselves purely from agricultural activities. The survey, which covered some 3% of the inhabitants, did reveal, however, that some 90% of the population is active in the agricultural sector during the sowing and harvesting periods, suggesting that even the urban population has close links to the agricultural sector.

The necessity for outside employment derives partly from the size of the average land holding - less than 8 hectares per family according to the CORDECO study - and partly from the continuing drought conditions suffered by the Valles Altos. Adequate agricultural production and incomes in the district depend heavily upon access to irrigation, which is limited.

The CORDECO study indicates that 23% of the land area of interviewed families was irrigated, but this must either be incorrect or unrepresentative of the district as a whole, for this would suggest that as much as 12,000 hectares of the total arable area of just over 50,000 hectares is under irrigation. Instead, data provided by PDAC irrigation staff (Buck Richards, personal communication) and by the Hydrological Department in CORDECO itself (DESFIL, 1987; Section III, p.9) place the total irrigated area at no more than 5,000 hectares.

Even accepting the CORDECO estimates for irrigated acreage, returns from agricultural activity are extremely low. Net returns per 'typical' hectare (comprised of a representative mix of crops) were placed at Bs.511 in Mizque Province and Bs.285 in Campero, suggesting that typical on-farm incomes do not exceed Bs.2,500 or Bs.1,250 per annum respectively. These numbers, however,

exclude on-farm consumption and appear to include high production costs - gross incomes are placed at nearer Bs.7,500 and Bs.4,500 for the two provinces.

Off-farm earnings are derived from such sources as agricultural labour for other farmers, estimated at Bs.8/day (plus food) by CORDECO staff, employment in Cochabamba, or from seasonal out-migration, usually to the Chapare. This last route is believed to be by far the largest source of earnings for most Valles Altos families.

Finally, the CORDECO study suggests that 74% of available hectarage is cultivated and that more than 98% of holdings are owned by the family. Mechanization is limited, with the study identifying tractor ownership in less than 5% of families. Even this is probably a high estimate as the survey focused on the more developed areas of the district. Donkey ownership was, however, fairly widespread.

2.3 Key Institutions

Three levels of institutions can be identified within the Chapare and Valles Altos regions which undertake activities relevant to agricultural and agroindustrial production; governmental, volunteer groups (NGOs) - both national and foreign, and local community and producer groups. Each of these will be considered briefly in turn.

2.3.1 Government Institutions

Three government institutions are of key importance to the areas under consideration; the Cochabamba Alternative Development Program (PDAC), the Chapare Regional Division of the National Agrotechnology Institute (IBTA Chapare) and the Departmental Development Corporation (CORDECO). In addition, the United Nations Program 412 (Agroindustry), while not technically a government institutions, falls most appropriately in this category.

The PDAC falls administratively under the Ministry of Agriculture and Peasant Affairs (MACA)and operates with funding from USAID. Established in 1987 as a reorganization of the old Bolivian Tropical Development Administration (SDTB), the PDAC was given the responsibility for coordinating and overseeing efforts to reduce coca production and sale in the Chapare. In this activity it works closely with a number of other institutions including the Agricultural Reconversion Directorate which is responsible for payments to farmers eradicating coca plantations. As part of its mandate, the PDAC is also responsible for supporting development activities in the Valles Altos.

With an extensive internal staff and several direct hire USAID advisors, PDAC plays an active role in extension services, credit, marketing development and, in the Valles Altos, irrigation infrastructure. Largely because of its direct financial support from USAID, the PDAC has both the resources and the staffing to undertake a variety of activities, although conscious efforts have been made to support other institutions where possible. As a result, it provides funding and administrative support to such groups as IBTA Chapare and a number of NGOs active in the two regions.

IBTA Chapare, by contrast, has a much narrower range of interests, focusing exclusively upon agricultural field research and extension in the Chapare. To this end IBTA Chapare operates

two field stations within the district, one at La Jota, focusing principally upon crop production, and one at Chipirriri which is responsible for livestock and pasture work. The La Jota station, which is the longest established of the two, employs over 40 staff and undertakes field research programs in most crops of relevance to the Chapare, including citrus, bananas, cocoa, yuca, spices, and tropical fruits.

In addition, IBTA Chapare maintains 9 extension agencies, employing some 20 agents distributed throughout the Chapare. Earlier tensions in the Chapare, as well as the perception that IBTA Chapare was a player in government efforts to limit coca production, led to IBTA Chapare limiting many of their efforts to land owned by the experimental stations. Until recently, therefore, extension services have been extremely restricted in scope and have tended to focus on a select group of only 53 progressive growers.

As a result, while IBTA Chapare has extensive material relating to on-station trials, including a collection of nearly 70 native fruit and palm species, knowledge of the remainder of the Chapare is limited. Extension agents have been active, however, in the promotion of new varieties and in particular in the distribution of seedlings and other genetic material produced on the La Jota station.

IBTA Chapare does not operate in the Valles Altos, although the national IBTA organization (with which IBTA Chapare has few links) maintains a specialized grape research station in Mizque (IBTA-PRODEVE), and a general research facility in San Benito on the edge of the Esteban Arce districts included within the PDAC territory.

CORDECO is one of a series of development organizations operated by each of Bolivia's Departments (the primary internal political division). It has responsibility for promoting economic growth within the Department of Cochabamba, which includes both the Chapare and the Valles Altos as well as a number of other districts. It has undertaken the sponsorship of a number of agroindustrial activities, including export production of flowers, irrigation and reafforestation projects, a tea processing plant in the Chapare and fruit production in the Valles Altos. It is already active in, or developing plans for, several areas of activity of direct interest to this study, including spice and cochineal production in the Valles Altos.

CORDECO receives considerable funding through joint projects with GTZ and JAICO, the German and Japanese development agencies, among others, but is dependent largely upon the Bolivian government for basic operating costs. A considerable portion of CORDECO's project budget is devoted to irrigation infrastructure development, including dams and water delivery systems.

As is the case for CORDECO, the **United Nations Program 412**, funded by the United Nations Fund for Drug Abuse Control, is also active in many areas of interest to this study. Operating only in the Chapare, Program 412 funds feasibility studies and establishment costs for a number of agroindustrial activities. Current efforts involve the promotion of a major citrus processing facility to potential private investors, the final planning stages for a small-scale menthol extraction plant, plans for a banana processing operation (glucose and vinegar), and plans for a animal feed component plant (carbohydrate derived from yuca).

Of key importance for this study is the fact that Program 412 has funds available to establish equity positions in new agroindustrial operations. In the case of the citrus plant, for example, which has been costed at more than $5 million, Program 412 is willing to invest close to 50% of the equity.

2.3.2 Non-Governmental Organizations

The general poverty faced by inhabitants of the Valles Altos district, coupled with the lack of political problems in working there in the past (as compared to the Chapare), has been conducive to the establishment of NGOs in that area. By contrast, the Chapare possesses no strong NGOs.

The strength of the NGO movement in the Valles Altos has led the PDAC to pursue a deliberate policy of channelling their efforts in this area through these organizations, and many of the groups operating there now receive financial and logistical support from PDAC.

The most important group in Mizque is **CEDEAGRO** (Centre for Agricultural Development), established in 1985, and operating with private funds from Belgium as well as donations from Oxfam and PDAC. Operating under a five year agreement with the Central Peasant Farmers' Organization, CEDEAGRO maintains a field station and 13 full-time staff working in the areas of community health, irrigation, drinking water, reafforestation and field trials of improved varieties and husbandry techniques. It possesses no extension staff or basic research services. Its principal focus in the past has been on onions, peanuts and potatoes, all important crops in the Mizque area, although recently considerable attention has been paid to the development of warm temperate and tropical fruits, including peaches, strawberries, chirimoya, lemon, raspberry, passion fruit and avocado pear (all in production).

CEDAGRO has some experience in promoting marketing of local crops - principally potatoes to Cochabamba. Local farmers have been assisted in bulking their loads together to enable them to rent an entire truck, reducing their costs from approximately Bs.5/Quintal (approximately 100lbs) to Bs.3/QQ. CEDEAGRO is planning to expand this marketing assistance to include onions and peanuts as well.

A second Mizque based NGO is **PROCIPLA** (Integrated Pest Control Program). Established in 1988 and purely a local NGO, it operates almost exclusively on funds from PDAC and in cooperation with the main university in Cochabamba (UMSS). PROCIPLA maintains a staff of approximately 10 persons (including students working on theses) and until now has focused upon pest control problems in the traditional crops (potatoes, peanuts, maize). In particular, it has carried out research in areas such as the use of associated crops, rotation cycles and intercropping.

Several NGOs are active in the Aiquile region of the district, including **ASAR** (Association of Rural and Handicraft Services). Funded largely by PDAC, ASAR maintains seven technical staff (plus support workers) and is active in extension services in livestock improvement (sheep and goats), forage production, soil conservation, irrigation cropping systems and handicrafts (sweaters, pottery etc.). They have had little direct participation in marketing as yet.

A strong Italian presence in the Aiquile area is reflected in two NGOs, **Cooperacion Internacional** and **Radio Esperanza**. Funded principally by the Catholic Church and the Italian Government, these two organizations support a number of activities including, in the case of Cooperacion Internacional, a 30 hectare farm in Chinguri. Operated principally as a demonstration

unit, and managed by an Italian agronomist, the farm has concentrated on horticultural and fruit crops, including strawberries, chirimoya, tomatoes, carrots, peanuts and lettuce.

Since its establishment in 1987, the farm has also developed approximately 12 community orchards throughout the area, usually in cooperation with the Mothers Clubs organized by Radio Esperanza. The farm has also distributed improved genetic material and seeds to interested growers.

Radio Esperanza, established in 1978 and with a staff of 20 persons, is built around a church owned radio station that broadcasts as far as the Chapare. Although not primarily agricultural in focus, Radio Esperanza undertakes a number of activities, including a sporadic price information service on the radio for regional markets, and an agro-forestry component, expected to plant some 300,000 trees in 1989-90, of which some 5-10% will be fruit trees (principally chirimoya, avocado pear and citrus) and 80% eucalyptus.

Other activities include a potato seed program, community infrastructure (access roads, drinking water) a literacy program and, through an associated charity **CARITAS**, the formation and support of Mothers Clubs, which are active in community programs.

Radio Esperanza is also considering becoming involved in crop marketing, principally with respect to Maize, one of the local staples. Involvement may include direct marketing, the establishment of a small-scale processing plant (for animal feed), and the marketing of maize seed.

2.3.3 Local Community and Producer Groups

One of the most important institutions in both the Chapare and the Valles Altos is that of the Sindicato. Bolivia is famous for the strength of its rural social organization, and the sindicatos form the core of this structure. Primarily community-based political groups, the leadership is chosen through a mixture of seniority and democratic election and wields considerable power in determining community activities and attitudes.

Sindicato approval is essential for most new enterprises involving local inhabitants and in many cases are powerful enough to control the type and extent of crops grown by their members. Powerful sindicatos also exist for non-agricultural groupings, for example, transport owners and drivers, although here they take on more of the traditional role of a union.

Producers' organizations also exist throughout both the Chapare and the Valles Altos, representing growers of specific commodities, but require the approval of the sindicato(s) in their area to operate. In the Valles Altos, these producer associations include those representing growers of grapes, potatoes, maize and peanuts, while in the Chapare, a number of newer associations have sprung up, many supported by the UN Program 412, including groups representing producers of yuca (40 members), cocoa (30 members), turmeric, tea (40 members), coffee (30 members), rubber (30 members), nursery plants (9 members) and lemon grass (120 members). Generally possessing only a limited membership (usually less than 50), these groups lack the organizational strengths and infrastructure possessed by some other groups in Bolivia - the Cocoa Producers Association of the Beni, for example, has more than 3,000 suppliers and operates its own transport fleet, processing facilities and input supply system.

A number of local geographically-based producer groups have also sprung up, principally in areas of the Chapare where the sindicatos have not established themselves fully. These include the Chimore Producers' Association (over 150 members) which groups producers of lemon grass, tea, bananas and stevia, and the Association of Producers of the Left Bank of the River Chapare. Other groups include the Association of Tropical Agricultural Producers with 20 members, based in Puerto San Francisco. This group contains members from 5 different sindicatos.

2.4 Overview of the Marketing System

Current marketing systems for products derived from the Chapare and Valles Altos are rudimentary. Almost no agroindustrial purchasing occurs in either of the two areas, although extremely limited amounts of lemon grass, for example, are processed by the producers themselves in the Chapare and sold to Agroquimico, a joint venture of the Cochabamba University (UMSS) and CORDECO.

2.4.1 Valles Altos

In the Valles Altos, data suggests that only limited amounts of overall production are consumed on-farm, ranging from 42% of wheat (wheat prices are maintained at a low level by PL 480 and other subsidised imports), to less than 1% of tomato production (CORDECO, 1989; p.27). Use of production for seed accounts for a few percentage points more, but generally between 65-95% of agricultural production is claimed to be marketed.

Several major marketing channels are used. Some production is sold directly to intermediaries (rescatistas) who travel from farm to farm collecting produce for bulk sale to wholesalers. A further percentage is taken by growers to one of the regional markets. At least six weekly markets are held within, or close to, the Valles Altos District. Buyers at these markets will mainly be wholesalers from Cochabamba, Sucre, Potosi or Santa Cruz, purchasing for resale in their home towns, although much of the maize is purchased by local chicherias, maize beer sellers. Some growers will transport their produce directly to Cochabamba, or less frequently to Sucre or Santa Cruz, where they will sell to a retailer or try to retail it themselves directly.

No accurate data exists for the proportion of produce flowing through each of these marketing channels in the Valles Altos, although a 1985 study of the Mesothermic Valleys of the Department of Santa Cruz (Cardona; p.83), which are contiguous with the Valles Altos, provides the following estimates:

On-Farm sale to intermediaries	46%
Sale to wholesalers, often through local markets	28%
Transported by growers to urban centres for sale to retailers	20%
Direct sale by growers to consumers	6%

For fruits, the Cardona study found that the role of intermediaries and wholesalers was reduced (to 40% and 21% of sales respectively) and direct sales by farmers to retailers increased in importance (33%). Direct sale to consumers was unchanged. For vegetable products, by contrast,

the role of the intermediary was much greater, reaching over 50% of sales, while sales to retailers diminished to only 13%.

In contrast to many parts of the developing world, the powerful role of the intermediary does not appear to result from a system of informal production credits extended to farmers. Only 4% of payments to growers were made in advance of the harvest, while nearly 50% were in cash at time of purchase and another 45% were on credit, with the intermediaries generally clearing their debts within 3 days of purchase. A further 2% of sales were barter exchanges. Credit was also used in sales to wholesalers, but accounted for less than one third of sales; the rest being in cash (Cardona, 1985; p.90)

Interviews with growers and other market participants suggests that the pattern in the Valles Altos is similar to that described above, although barter probably forms a more important component in the marketing system than in the Mesothermic Valleys. Often conducted at exchange rates that appear to bear little resemblance to current price structures, these ritualized exchanges traditionally take place between communities occupying different ecological zones (e.g. montane and valley communities) and are governed by a number of powerful social controls. They are thought to have evolved as a form of insurance system to guarantee access by communities with extremely limited production potential, to products from other communities. Once of crucial importance,these barter arrangements now account for only a limited percentage of product disposal, although a more modern form of barter, involving small livestock for clothes and other manufactured goods, appears to be growing in importance.

Post-harvest treatments are extremely simple. No product selection or grading occurs in most cases and product is often loaded loose onto trucks (frequently with passengers on top). Crates were only observed in use for tomatoes, while some products were placed in large bags. No structured or communal storage system was identified in the Valles Altos, although some on-farm storage does occur. Most production is sold within a short period of harvesting, however, leading to large price fluctuations during the year. Prices for 20Kg. of tomatoes in the Santa Cruz wholesale market, for example, fluctuated between Bs.3.12 and Bs.13.60 over the first six months of 1989 (CORDECRUZ Boletin Informativo Agropecuario, Aug. 1989; p.27) - a period when inflation was not a major factor. Even lettuce showed a range of Bs.4.62 to Bs.16.33 over the same time period.

Once again, data on harvest losses from the Valles Altos themselves is not available, but a 1986 report (Cardona & Thompson) undertaken for the Mesothermic Valleys quotes marketing system losses as ranging from less than 5% for cabbage to 20% for bananas. Tomato losses were placed at 15%, with carrot, lettuce and potato at 14%, 10% and 7% respectively.

Cardona's study (Cardona, 1985; p.58) tracked gross marketing margins - defined as percentage of final price accounted for by participants in the marketing system - for a range of products over the twelve month period Jan-Dec 1984 and demonstrated that margins also fluctuate substantially, although no direct connection appears to exist between price and the level of margin obtained. Oranges, for example, yielded a margin of 9.1% (expressed as percentage of final sale price absorbed by the marketing system) when selling at U.S.$0.027 each in August, 74% at $0.012 in May, and 82% when selling at $0.067 in January. Other typical margins include pineapple; from 44-75%, and banana; from 56-90%.

A 1986 survey of average gross marketing margins (Cardona & Thompson; p.2) calculated by different authors between 1968-1985 showed a range of from 87% of final sale price for choclo (a type of shelled corn on the cob) to 39% for potatoes. Tomatoes were calculated at approximately 55%, onions at 66%, carrots at 49% and pineapple at 72%.

From these gross margins a deduction must, of course, be made for the costs absorbed by the marketing system in terms of losses and transport costs. Losses are usually calculated in percentage terms and thus tend to remain constant as prices fluctuate. Transport costs tend to be absolute, however, rendering it difficult to state an average percentage cost to transport.

Using the hypothetical case of potatoes purchased on-farm in the Valles Altos during 1989 at Bs.50-55/100Kg and sold to retailers in Cochabamba during the same period at Bs.75-80/100Kg., for a gross margin of approximately 48%, we can add losses of 14% and transport costs of Bs.4-6/100Kg. including police tolls (data provided by CEDEAGRO staff). In effect, therefore, the intermediary/wholesaler is selling 86Kg. of potatoes for approximately Bs.66.5 (after losses) and having to give up Bs.52.5+5 in costs (purchase cost plus transport). The net marketing margin is thus reduced to 17%. Given the fluctuation in prices that occur, as well as in loss rates and transport costs, it is probably fair to say that the net wholesale margin at this period falls somewhere between 15-20%. No estimate of net retail margins was obtained.

2.4.2 Chapare

The marketing system in general within the Chapare is similar to that presented for the Valles Altos. A detailed study undertaken in 1987 (SPI Consultores) examined marketing aspects for 4 crops; bananas, citrus, pineapple and papaya.

Crops grown within the Chapare can be broadly divided into two categories - those grown for sale and those grown for on-farm consumption. Although, for example, considerable areas of maize and yuca are planted within the district, relatively little of this output enters the national marketing system. Among citrus crops, bananas and pineapples, by contrast, on-farm consumption is relatively insignificant.

With the exception of sales to wholesalers through local markets, which are not an established feature of the Chapare, the same set of marketing channels exists. The four principal sales routes open to growers are: local sale to consumers in the Chapare; transport to regional centres (Santa Cruz or Cochabamba) by growers, who then sell the product to local wholesalers; sale to intermediaries; or sale to transporter/wholesalers. The SPI report estimates the following percentages for the crops studied:

Crop	Local Sale	Sale to Regional Centres	Sale to Intermediaries	Sale to Wholesalers/Transporters
Bananas	4.5	22	7.5	67
Oranges	7.5	33	12.5	47
Pineapple	7.0	41	7.5	35
Papaya	2.0	28	5.5	65

As can be seen, the role played by the rescatistas (intermediaries) in the Chapare is far smaller than in the Valles Altos, while the influence of the wholesaler is much greater. Direct sales by farmers appear to be about the same. The reasons for these differences are not stated by the report but interviews with participants suggest the following factors: the greater volume of production originating from the Chapare, thus rendering it more worthwhile for wholesalers to involve themselves directly; the improved road conditions into and out of the Chapare, thus easing transport access; and the presence of two major regional centres within easy reach of the Chapare - Cochabamba and Santa Cruz - thus increasing the number of wholesalers purchasing in the area.

As is the case in the Valles Altos, little evidence exists for control of harvests and marketing by intermediaries who lend to growers to cover production costs. In the Chapare this may result from the fact that a major percentage of cash flow is generated by coca production, permitting production of other crops without extensive credit from traders. In contrast to the Valles Altos, however, the SPI Report claims that almost all transactions with wholesalers and other intermediaries are undertaken on a consignment system, which may in some cases be accompanied by an initial down payment. Only in the case of papaya did SPI report a preponderance of cash payments for the product, possibly due to the perishability of the product.

No storage infrastructure or other form of organized post-harvest handling was identified in the Chapare. Grading and sorting may occur informally but no set standards exist. Transport tends to be loose (especially for bananas) although bags may be used for oranges and other smaller products.

The SPI report details substantial harvesting losses at farm level but such numbers are notoriously difficult to substantiate. What are reported by growers as harvest losses may include preliminary product selection or, more commonly in the Chapare, failure to harvest at all due to low prices or lack of buyers. This latter is particularly prevalent for citrus and to some extent banana production.

Leaving aside on-farm losses, therefore, wholesale and retail level losses estimated by the SPI study produces results in the following ranges:

Crop	Study	Wholesale	Retail	Total
Bananas	SPI	8.8	11.9	20.7
Oranges	SPI	7.0	10.2	17.2
Pineapple	SPI	13.5	13.5	27.0
Papaya	SPI	22.4	9.8%	32.2

These figures are in general higher than those reported by Cardona & Thompson (1986), although the difference is not always significant. Banana losses, for example, at 20% are identical in both cases. Other differences may be accounted for by the more perishable nature of the products involved in the Chapare.

Estimated gross marketing margins (excluding costs and post harvest losses) for the products covered by the SPI report extent over a considerable range, from as high as nearly 90% in the case of papaya, to only 54% for pineapple. Bananas were calculated at 86% and oranges at 68%. The Galindo study yielded similar figures, placing orange margins at 85%, banana margins at 76% and pineapple margins at 50%.

Historical data supplied in the SPI report shows no clear trend in gross marketing margins over a 7 year period (1979-1986). While papaya marketing margins had increased, from 63% to 89%, pineapple marketing margins had declines over the same period from 66% to only 54%. Margins for citrus had remained fairly stable and margins on bananas had apparently moved randomly, ranging from 92% in 1984 to 80% in 1981.

Net margins - i.e. those after subtraction of marketing costs and post -harvest losses - are, not unexpectedly, considerably lower than gross margins, although still considerably higher than might be expected:

Crop	Report	Wholesale	Retail	Total
Bananas	SPI	43.0	6.6	49.6
Oranges	SPI	25.0	14.0	39.0
Pineapple	SPI	16.7	4.0	20.7
Papaya	SPI	37.9	27.9	65.8

While retail margins appear quite narrow, it would appear that, with the exception of pineapples, wholesalers are extracting significant profits from their trading activities.

These margins must raise the question as to why other wholesalers, or even farmers themselves, do not enter the marketing system more frequently to compete with existing wholesalers. No clear answer is available currently but possible inhibiting factors may include transport availability, a high degree of risk involved with the marketing process, and direct wholesaler-retailer linkages that render outsider entry difficult.

3.0 RAW MATERIAL AVAILABILITY

The efficiency of any agroindustrial marketing system must depend to a considerable extent upon the timely availability of suitable raw material. The term suitability, of course, includes a variety of different factors including varietal type, quality, and price.

It is not always the case, however, that an agroindustrial system is based upon existing supplies of raw material. Current agricultural output may not possess the requisite characteristics for processing, or market demand may be strongest for products based upon crops not currently grown. Ideally, therefore, the planning of a successful agroindustrial marketing system should commence with an analysis of current and anticipated market opportunities and only **when key market opportunities are identified,** should the study subsequently turn to a review of the potential of these products in the target area.

In the real world, however, such a wide ranging market study is beyond the resources of most planning exercises. To limit the range of products analyzed, therefore, it makes sense to undertake a preliminary survey of agronomic potential within the area under examination and focus the market study on these categories of products. Such a survey may also assist in determining the types of factors that must be considered in evaluating other stages of the agroindustrial marketing system, such as processing, storage and transport.

To provide this initial assessment, therefore, the following section provides a review of crops in both Chapare and Valles Altos at three levels; traditional crops, non-traditional crops, and potential new crops. In theory, at least, these categorizations are quite clear. Traditional refers to crops widely and generally grown in their respective areas. Non-traditional refers to crops grown only by the more adventurous or progressive farmers, but which have yielded good results in agronomic terms. New crops refers to crops which are not yet commercially exploited but which show promise in terms of field trials or similarity in agroclimatic requirements to existing species.

These divisions are not always as easy to establish in real life, however, as they are on paper, and considerable room for argument exists as to which category is appropriate for which crop. It should be remembered in such cases that the divisions proposed are no more than matters of convenience and are not intended to imply any rigid separation. Finally, to avoid any possible confusion concerning the local name (in Spanish) of a crop, this is provided after the english name at the beginning of each descriptive section.

It should also be noted most clearly that almost all data relating to both the Chapare and Valles Altos areas is lacking in any statistical validity. The numbers quoted in the following section should invariably be treated with caution and, where appropriate, some degree of scepticism. In the Chapare area, farmers relying heavily in the past on coca for their principal source of income have been understandably reluctant to answer questions concerning their cultivation practices and planted areas, leading to conflicting answers and, in some cases, obviously incorrect results.

Fortunately, it appears that this attitude is changing as coca loses its financial attractiveness and growers are more and more keen to develop alternative sources of income. The PDAC is, at the time of writing this report (April 1990), about to commence the first truly statistically significant assessment of production volumes and areas in the Chapare and it is hoped that this information gap will be gradually eliminated.

In the Valles Altos the lack of reliable data derives primarily from a past lack of official interest in the area. There is no reason that accurate data should not be available, beyond the fact that nobody has bothered to collect it; not even the 1984 Agricultural Census included crop data for the Valles Altos. With the entry in 1987 of the Valles Altos into the PDAC program it is to be hoped that this deficiency will soon also be overcome, but after 3 years there is still no proper production survey planned for the area.

The problems in the Valles Altos are compounded by the lack of any equivalent to the La Jota experimental station in the Chapare. At least La Jota has been able to institute a series of applied research programs to estimate likely yields, disease problems and the like for new crops. With the exception of small-scale efforts by CEDEAGRO and ASAR (see Section 2.3), no similar program of investigation exists in the Valles Altos.

Finally, when considering yield data it should be borne in mind that current production practices almost entirely exclude the use of fertilizers and chemical treatments, as well as appropriate pruning practices in the case of tree fruits. Yield data, therefore, when available, should be viewed as the minimum obtainable under current conditions. The introduction of guaranteed markets for farmers' products, combined with effective extension and credit programs, can be expected to increase these yields significantly.

3.1 Traditional Crops

Approximately a half-dozen crops in each of the Chapare and the Valles Altos regions account for the vast majority of current agricultural output (excluding coca). While new varieties have been introduced in some cases, all of these crops are well established and widely grown according to traditional practices. These established crops are described in more detail below.

3.1.1 Chapare

Key traditional crops of the Chapare include oranges, mandarins, grapefruit, bananas, plantain and yuca. Other crops such as maize are quite widely produced but almost entirely at a subsistence level and do not enter into the commercial operations of Chapare producers.

ORANGE (Naranja):

The citrus sector of the Chapare has been extensively studied over the last decade and a number of estimates exist as to current yields and production. Unfortunately, these data are frequently contradictory, even in some cases when derived from the same source. Yield estimates vary between 12 and 25 MT/Ha. and areas in production between 2,500 and 5,250 Hectares. The result is a range of total production estimates extending from 34,000 Mt to over 130,000 Mt. annually (see Table 3.1).

TABLE 3.1: ESTIMATED YIELDS, AREA AND PRODUCTION OF TRADITIONAL CROPS IN THE CHAPARE & VALLES ALTOS REGIONS OF BOLIVIA

CROP TYPE	VARIETIES	SOURCE	YIELD (MT/HA)	AREA (HA)	PRODUCTION (MT)
CHAPARE:					
Oranges	Valen. Tardia	SPI 1987	14	2,450	34,300
	Val. Temprano	PIDYS 1988	16	3,500	56,000
		MACA/IBTA 1987	12	2,870	34,440
		IBTA Agron.1990	25	5,250	131,250
Mandarin	Honey	SPI 1987	12	490	5,880
	Kara	MACA/IBTA 1987	21	-	-
		IBTA Agron.1990	21	1,750	36,750
Grapefruit	Pink	SPI 1987	13	205	2,665
	White				
Bananas	Cavendish	SPI 1987	16	7,075	113,200
	Guineo	UN Prg.412 1990	8	12,500	100,000
Plantain	Robusta	SPI 1987	17	2,700	45,900
Yuca	Suelacara	IBTA Agron.1990	20-40	0-30,000	500,00-
	Bobori				750,000
	Amarilla				
Papaya	-	SPI 1987	12	250	3,000
VALLES ALTOS					
Maize	Amarillo	CORDECO, 1988	1.1	15,208	16,729
		COPLACO	1.2	8,979	10,775
		ASAR Agron.1990	0.9	-	-
Potato	Runa	CORDECO, 1988	5.8	8,402	48,732
	Papa Holandes	COPLACO	5.6	1,273	7,129
Wheat	-	CORDECO, 1988	0.8	495	396
		COPLACO	0.8	3,699	2,959
Tomato	Manzana	CORDECO, 1988	12.4	988	12,251
	Perita	COPLACO	8.5	806	6,851
Peanut	-	CORDECO, 1988	2.4	1,404	3,370
		ASAR Agron.1990	0.4	250	100

Two key factors have probably contributed to this confusion. Firstly, oranges, like many other tree crops in the Chapare, are frequently planted as cover for growing coca plantations. Under this use they are almost always planted at wider than normal spacing, and may not even be harvested. Some surveyors will have included such plantations as full hectares, while others will have discounted or ignored them altogether.

Secondly, improved varieties have been introduced in recent years, accounting for an estimated 10-20% of the total area in production. Even this figure may be optimistic - IBTA Chapare data indicates that only the equivalent of 100 Has. of improved stock have been distributed since 1985, although private vendors of planting material do exist. The improved varieties, principally Valencia Tardia and Valencia Temprano, can be expected to receive better attention than the predominant 'Criolla' tree and may account for the higher yield estimates provided by some authorities.

In the 1989 IBTA citrus report (Rojas; p.6) the most credence is given to the PIDYS estimates of 16MT/Ha. and 3,500 producing hectares, for a total of somewhere over 50,000MT/year, although the author of this report himself subsequently estimated (IBTA Agronomist, 1990) a much higher figure for both area and yield.

Harvest periods are April-July for the Criolla variety and July-September for the Valencia Tardia. No harvest period is specified for the Valencia Temprano. Average wholesale prices in Santa Cruz in February 1990 were Bs.10/100 units or approximately Bs.500/MT (US$163). Wholesale prices over the last 6 months had ranged between Bs.8-20/100 units. Rojas (1989; p.17) reports an average fruit weight of 220g. and an average juice percentage of 46% (the Criolla slightly heavier, the Valencia slightly juicier).

Partly as a result of the predominance of the Criolla variety, and partly as a result of climatic factors (a high proportion of humid, cloudy days), juice content from Chapare fruit tends to be low in both solids (average 9.2 Brix for Criolla and 9.6 Brix for Valencia Tardia) and acid percentage (0.81 for Criolla and 1.28 for Valencia). As a result, the Chapare fruit, despite the attractive volumes available, has traditionally been viewed as unsuitable for processing. Del Valle, the only drink manufacturer in Bolivia using domestic supply sources, has stated that it is due to this quality problem that it will buy oranges only from the Yungas area (adjacent to La Paz).

In addition, Criolla varieties suffer from uneven size and quality of fruit, disease susceptibility, and difficulty in harvesting due to the size and spiny nature of the trees (Rojas, 1989; p.8).

Despite these difficulties, a number of organizations and individuals are proceeding with plans to establish major citrus processing operations in the Chapare region. Most significant of these is the proposal put forward by the United Nations Fund for Drug Abuse Control (UNFDAC) under its Program 412. With a proposed raw material consumption of 40,000Mt of oranges per year, in addition to other fruit, the plant is intended to produce some 2,835MT of Fresh Concentrated Orange Juice (FCOJ, at 60-65 Brix), 113MT of orange oil and 12MT of citrus essence annually (UN,1989; Exec.Summary).

The internal rate of return (IRR) for the project, which has an estimated total investment cost of US$5.6 million (including other fruit processing operations), is given as 30%. The Criolla fruit, it is said, can produce USDA No.2 grade juice when properly processed and the FCOJ would be sold frozen in 280Kg. drums for US$1,350/MT ex-factory. UNFDAC is currently looking for private sector investors willing to take a 51% or greater share in the plant. UNFDAC would fund the remaining 49% and gradually transfer their equity to the producers' association formed to supply the factory - agreements have been reached with growers to supply output from 2,000Ha. at an estimated price of US$42.50/MT (UN,1989; p.52)

At least two other citrus processing plant proposals are also being explored, one of which would cost in excess of US$25 million and involve Italian financing.

MANDARIN (Mandarina):

The second most widely grown of the region's citruses, the Mandarin probably accounts for somewhere in the region of 1,000 Ha. at an average yield of approximately 15-20MT/Ha. for a total production of 15,000-20,000MT. (see Table 3.1).

Although, as in the case of the orange, improved varieties do exist (Honey, Kara), they are believed to account for only a tiny percentage of all Mandarin production.

Mandarins are harvested over a considerable time period, stretching from January-June (Rojas,1989; p.17) and fetched average wholesale prices in Santa Cruz over the six months up to February 1990 of Bs.14/100 units or Bs.1,120/MT (US$365), apparently a considerably more attractive proposition financially than oranges, given their equal or higher yields.

Again, as for oranges, the Criolla mandarin trees are tall and spiny, producing fruits with an average weight of 123g. each and abundant seeds (Rojas, 1989; p.14). Suitability for industrial processing is reduced by the low juice content of criolla mandarins (36% according to Rojas), although the improved varieties, such as Honey and Kara, present average juice contents of 50% or higher with much heavier fruit.

GRAPEFRUIT (Pomelo):

Only a single estimate is available for grapefruit (SPI, 1987), suggesting that little more than 200 hectares of grapefruit, principally Ruby Red and White, are planted in the Chapare, yielding an average of perhaps 12-15MT/Ha. for a total production in the order of 3,000MT.

Wholesale prices in February in Santa Cruz averaged Bs.16/100 units (close to the six month average of Bs.16.50) but no average weights are given in any of the reports for grapefruits, rendering a price per MT difficult to establish.

The previously mentioned UNFDAC plant is planned to purchase 500MT of grapefruit per year at a price of US$30/MT and produce 42MT of FCGJ (55 Brix) and sell it in 280Kg. drums ex-factory at $1,300/MT. The plant would also produce approximately 8MT of grapefruit oil per year.

BANANAS (Guineo):

Bananas constitute the most important agricultural product of the Chapare, by both area cultivated and total production. The SPI study places yield at 16MT/Ha., while the UNFDAC estimate of 8MT/Ha., while perhaps low, may reflect the lack of fertilizer, fungicides and other adequate husbandry methods in relation to banana production. Total area planted is probably in the region of 10,000 Has. for an overall output in the region of 100,000-120,000MT.

The predominant banana variety is the Cavendish, which is global in its distribution. No useable data exists for wholesale prices of bananas due to problems in defining the weight of a stem. The Proposed UNFDAC/Agroquimico plant (see below), however, would pay growers Bs.674/MT ($220).

The UNFDAC program, in cooperation with Agroquimico (a CORDECO /UMSS joint-venture) plans to establish a plant for the processing of banana for organic extracts (principally glucose and vinegar). With an estimated cost in the region of US$200,000, the plant would utilize 430MT of green bananas/year.

PLANTAIN (Platano):

Despite their considerable production levels in the Chapare - probably in the region of 30,000-45,000MT annually over as much as 2,700Ha. (see Table 3.1) - plantains have received very little attention by previous researchers.

The principal variety is claimed as Robusta and prices received appear to be some 25-50% higher at wholesale than for bananas and nearly double at retail.

CASSAVA (Yuca):

Cassava is grown extensively throughout the Chapare, although no accurate data is available with regard to the area of production. According to the IBTA Chapare agronomist responsible for cassava, a typical grower in the region plants approximately one third of a hectare, while those with livestock may plant up to one hectare.

Based upon rough estimates of the number of farmers in the Chapare, one can guess at a total area of somewhere in the region of 20,000-30,000Ha. - much of it intergrown with coca. In the absence of fertilizer application, yields depend heavily upon soil type with the agronomist quoting a range of 15-20MT/Ha. on poor soils, up to more than 40MT/Ha. on good soils. These yields can apparently be increased by more than 50% with the application of fertilizer. Based upon these estimates, overall production is likely to be in the range of 500,000-750,000MT/year.

The most common varieties are Suelacara, Bobori and Amarilla, with a typical content of 70% or more of starch, 50ppm of cyanic acid and a moisture content after two days of drying of 10%.

Farm gate prices are said to average Bs.215/MT for selected tubers, while feed manufacturers, who utilize unselected supplies, pay in the region of Bs.110/MT. Wholesale prices in Santa Cruz have averaged around Bs.330/Mt over the 6 months to February 1990.

The IMBA feed factory currently consumes some 2,500MT/year of cassava. The UNFDAC program is also developing a feed plant for operation in the Chapare at an estimated cost of US$40,000 which will utilize a further 1,000MT/year of yuca. The plant expects to pay slightly under Bs.300/MT.

PAPAYA (Papaya):

The only existing estimates for papaya, those of SPI (1987), place planted area in the range of 250Has. and yields at some 12.5MT/Ha., for a total production of some 2,500-3,000MT/annum.

Santa Cruz wholesale prices for papaya over the six months up to February 1990 averaged Bs.0.66 each, or estimating an average papaya at 840g (SPI,1987; p.266), the equivalent of Bs.780/MT. The SPI study reports that farm gate prices are approximately 20% of wholesale prices (largely as a result of the high loss rate for papaya when transported), suggesting typical farm gate prices in the region of around Bs.160/MT.

3.1.2 Valles Altos

With the exception of wheat, the traditional crops encountered in the Valles Altos are typical of many semi-arid areas of the developing world, encompassing maize, tomatoes and peanuts. Due to the Andean setting, potatoes also maintain their traditional importance as well.

The below average rainfall in the last four years has reduced output and marketing of these crops and may lead to a profound shift in cultivation patterns if the dry conditions persist or worsen.

CORN (Mais):

Yellow corn is the dominant agricultural product of the Valles Altos, particularly in Campero province, and it is extensively used in the local manufacture of chicha, a type of beer.

Yields are agreed to be low, averaging around 1MT/Ha. although even this figure may be skewed by the presence of irrigated areas. In recent years non-irrigated plots have often failed completely. The two existing estimates for area planted differ widely but there are probably in the region of 10,000Ha. cultivated annually.

Most corn is consumed locally and recent prices were reported at Bs.450/MT in Aiquile, the regional centre for Campero province. During February, 1990, animal feed manufacturers were paying approximately Bs.275/MT for yellow corn.

Radio Esperanza, the Catholic NGO operating from Aiquile, is planning a major effort in corn, focusing upon the development of seed, animal feed production and marketing channels.

POTATO (Papa):

While corn is the key crop in Campero, in Mizque province the focus is upon potatoes. Both Dutch and local Runa varieties are planted and are estimated to yield between 5-6MT/Ha. As for corn, however, considerable differences exist in estimates of planted areas, with the CORDECO study (1988;p.25) yielding a figure of over 8,000Ha. and the COPLACO study claiming only 1,273Ha.

Potato production has not only been hit severely by the drought. A major market for Valles Altos potatoes, the mining communities of Potosi and the Altiplano, has diminished considerably with the collapse of tin prices and the closure of many mines. In addition, the Mesothermic valleys of Santa Cruz Department have become significant potato producers, sometimes competing directly with Valles Altos production in such centres as Cochabamba.

According to staff at CEDEAGRO, farm gate prices in Mizque have fluctuated between Bs.250-550/MT, with the higher range attracting wholesale prices in Cochabamba of around Bs.800/MT.

WHEAT (Trigo):

Wheat is grown in the Valles Altos primarily for on-farm consumption, with less than 50% marketed (CORDECO, 1988; p.27). Nevertheless, it is one of the more important crops, with a total planted area of probably 1,000-2,000Ha. and a yield of about 0.8MT/Ha.

It is widely stated that the extensive import of wheat through assistance programs such as the PL480 program of the U.S. government, maintains wheat prices at artificially low levels and hence renders it an unattractive crop for commercial production. This assertion was difficult to check as no sources of quotations for in-country wholesale wheat prices were found. However, during the period of field work, wheat flour was selling in wholesale markets for Bs.1,150/MT.

TOMATO (Tomato):

Traditionally a major cash crop in irrigated areas of the Valles Altos, tomatoes have the highest level of off-farm sale of any crop covered by the CORDECO study - 99% marketed (1988;p.27).

Yields are estimated at between 8-10MT/Ha. and area planted at close to 1,000Ha., for a total production of probably 8-10,000MT, principally to the varieties Manzana and Pera; descriptive terms for the tomatoes' shape.

Due to their fairly rapid growth and responsiveness to environmental conditions (particularly water availability), tomatoes are famous in Bolivia for the extreme range of prices which they can fetch in the market. While in June of 1989, for example, tomatoes were selling wholesale at Bs.2,000/MT (US$650), by December the price was Bs.50/MT ($16). Typically, however, the prices are nearer the lower, rather than the upper, end of this range.

One of the major food processors in Bolivia (Dillmann) has apparently had a tomato processing plant standing idle for several years in Cochabamba. Dillmann's refusal to discuss their operations with the team makes it difficult to be certain of the reasons for the plant's inactivity, but it is said that the current varieties grown in the Valles Altos are not suitable for processing.

PEANUT (Maní):

The extreme divergence of estimates with regard to peanuts renders any overall number of limited value. On the one hand the CORDECO study places average yields at 2.4MT/Ha. and area planted at 1,400Ha., while on the other hand technicians at ASAR, a local NGO, estimated yields at less than half a ton per acre and total area planted at perhaps 250Ha. While the ASAR estimate may be pessimistic, their local knowledge would suggest that their numbers are closer to reality than the CORDECO study. A believable estimate, therefore, may be in the region of total output of approaching 500MT.

These large discrepancies in estimates are probably a further result of the drought conditions in the area in recent years (the CORDECO data would have been based upon 1987 production) and the importance of defining whether one is talking of irrigated or rain-fed areas. Certainly 400Kg/Ha. is low for irrigated production but is quite reasonable under drought conditions for rain-fed land.

Marketing problems were also claimed to be serious by the ASAR agronomist in Aiquile, although February 1990 wholesale prices for shelled nuts were varying between Bs.1,400-1,800/MT depending upon size and quality.

3.2 Non-Traditional Crops

Efforts to provide an alternative to coca production in the Chapare over the last decade, as well as the declining market for potatoes and drought problems in the Valles Altos, have all led to considerable interest in the development of non-traditional crops for production in these areas.

Some of these crops, such as turmeric and chirimoya, appear to be gaining rapidly in popularity and marketing problems may become evident in the near future. Other crops, such as coffee, cocoa and grapes, appear to have already experienced grave marketing difficulties and have declined in popularity in recent years.

It is in this area of non-traditional crops that USAID and the PDAC face their most difficult choices. While the more widely grown crops such as citrus, banana and potatoes developed indigenously, without government or institutional support, the non-traditional group frequently owes its presence in the Chapare and Valles Altos to research and extension activities of such groups as IBTA Chapare.

Yet unlike the potential new crops discussed in the following section, these non-traditional crops already have committed constituencies such as producer associations. Strong pressure thus exists for further expansion and development of crops in this category. It is far from certain, however, that these crops all possess the necessary characteristics to justify such expansion. Where promotion efforts fail, the result is wasted resources on the part of development institutions and

disappointment and disillusion on the part of farmers. Considerable care must therefore be taken that further development efforts are justified both agronomically and financially in the case of each crop.

Marketing aspects are discussed separately in the second volume of this report. In this section the emphasis is placed on apparent agronomic suitability.

3.2.1 Chapare

A number of crops are in production in the Chapare in relatively small quantities, covering the range of fruits, spices and what are viewed elsewhere as 'traditional' commodities (coffee,cocoa). All appear to possess some agronomic potential but all are linked by the absence of established marketing mechanisms for more than the smallest levels of output.

PINEAPPLE (Piña):

It appears that pineapple has experienced a cyclical trend in production in the Chapare over the last decade or so. According to the SPI report (1987;p.212) production peaked in the early 1980s with more than 400Has. in production. By the time of their study five years later, this had declined to 245Has. and the IBTA Chapare agronomist in charge of pineapples estimates that in 1989 there were only 60Has. in production. An upswing in production appears to be in progress again and this area is expected to rise to 80Has. in 1990.

Yield figures are more problematic. SPI estimated yields at only 24MT/Ha., a very low figure, while the IBTA Agronomist estimates yields at 100MT/Ha. (see Table 3.2) but this is probably more an expression of what is possible than what is currently being achieved. Nevertheless, the newer producers are seemingly more willing to apply fertilizers and other chemical treatments, suggesting that 100MT may not be an impossible figure.

Higher yields are only possible with the variety Cayenna Lisa. Averaging 2.5Kg/fruit and grown specifically for processing, it is planted at a rate of approximately 42,000-44,000/Ha. but currently accounts for no more than 20% of the planted area. Unimproved varieties such as the Criolla and Perolera, averaging no more than 1-2Kg/fruit, predominate and are used primarily for table consumption, although some is processed. Planting densities for the criolla varieties are considerably lower, and yields rarely exceed 30MT/Ha.

The observed swings in production of pineapple appear to result principally from fluctuating processing demand in Santa Cruz and Cochabamba. During the early 1980s tinned pineapples were exported to Argentina through a processing plant in Santa Cruz (ENAVEL) with a capacity of some 80MT of fruit/day. Problems with the quality of tins used, as well as competition with the fresh market for raw material, resulted in the cessation of exports in the mid-1980s and a collapse in the pineapple market in Bolivia. Recently, a number of small processing operations have started up (La Granja in Santa Cruz, for example, bought 28,000 pineapples last year) and COBOCE, a major Bolivian cooperative, has purchased the old ENAVEL plant mentioned above with the objective of reactivating it.

TABLE 3.2: ESTIMATED YIELDS, AREA AND PRODUCTION OF NON-TRADITIONAL CROPS IN THE CHAPARE & VALLES ALTOS REGIONS OF BOLIVIA

CROP TYPE	VARIETIES	SOURCE	YIELD (MT/HA)	AREA (HA)	PRODUCTION (MT)
CHAPARE:					
Pineapple	Cayenna Lisa	SPI,1987	24	245	5,880
	Morada	IBTA Agron.1990	100	80	8,000
Turmeric	Falso Asafran	IBTA Agron.1990	21	12	252
Ginger	Grand Cayman	IBTA Agron.1990	10	5	50
Achiote	Material from CATIE, C.R.	IBTA Agron.1990	1.1	1	1
Tea	Assam	UN Prg.412,1990	5	30	150
Coffee	Arabicas;	UN Prg.412,1990	-	300	-
	Caturra, Catuai, Catimoro	Galindo, 1989	0.6	69	41
Lemon Grass	Cymbopogan Citratus	UN Prg.412,1990	56 (Oil;4Kg/MT)	40	2,240 (Oil;9MT)
Cocoa	Jamaican Var.	UN Prg.412,1990	-	22	-
	Ecuador Var.	IBTA Agron.1990	0.3	20	0
VALLES ALTOS:					
Grapes	Muscatel	Navia, 1990	2.4	15	36
	Torrontez	PRODEVE, 1990	8	15	120
		COPLACO	4.7	98	461
Cumin	-	CORDECO,1988	0.5	50	25
Chirimoya	-	COPLACO	6.2	64	397
		CI Agron, 1990	8	-	-
Avocado	-	COPLACO	4.1	38	156

NOTES: Quoted sources not listed in bibliography are personal communications.

CORDECO 1988 data extrapolated from survey covering 2.8% of ng 2.8% of current estimated population.

Valles Altos data in all cases refers to Distrito Sur (Mizque & Campero Provinces) only. Esteban Arce data is not available separately.

La Granja is currently paying Bs.0.90/fruit for primarily criolla pineapples weighing between 0.9-1.5Kg. each (Bs.7,500-8,000/MT), while on-farm prices were reported at Bs.0.5-1/fruit. Wholesale prices in Cochabamba were averaging double this rate, partially due to an estimated 20% marketing loss rate for the fruit (IBTA Agronomist; personal communication).

TURMERIC (Curcuma):

Turmeric is one of the two non-traditional crops facing the strongest pressure for marketing assistance. It is estimated that approximately 200-250MT will be harvested from some 20 hectares in the Chapare from May to November of this year (Table 3.2).

Principally of the orange variety (Falso Asafran), the turmeric has been analyzed at 4.99% active ingredient (international standards require 5%). Current national market prices are in the region of Bs.1,350-1,750/MT. for washed, chopped and sun-dried product. While the price is estimated to provide acceptable returns to growers, national demand is very limited and international markets will have to be identified if production is to continue.

According to agronomists in IBTA Chapare, turmeric is well suited to production in poor soils and thus has considerable potential in many areas previously dedicated to coca production. Ideally, however, the turmeric should be cultivated at altitudes of 500m or above, limiting it's area of production to the Western end of the region.

GINGER (Jengibre):

Although it has been grown in the past, the current production of ginger - some 10Has. - is newly established with assistance of the La Jota experimental station. Principally of the Grand Cayman variety, derived from Costa Rican planting material, the Chapare ginger yields 16-18MT/Ha. on La Jota and perhaps closer to 10MT/Ha. in normal production among small farmers (Table 3.2).

Agronomically, ginger appears very well suited to conditions in the Chapare, growing in almost all sub-zones, although some susceptibility to fungal attack has been noted.

Along with turmeric, ginger faces severe marketing problems, compounded by the fact that the harvest for 1990 was underway at the time of the team's field visit, necessitating urgent attention to markets. Korr, a small-scale local spice processor, has agreed to purchase 10MT, but domestic demand will likely be filled with this quantity, rendering foreign buyers essential. Some extremely limited experimentation is underway to determine the practicality of extracting ginger oil for international sale.

The Grand Cayman variety of ginger is expected to fetch approximately Bs.$4,000/MT. in national markets, in comparison with the less desired Japanese type, currently trading at approximately Bs.2,000-2,500/MT.

ACHIOTE (Achiote):

Achiote (also known as Anatto) is a native andean tree that produces seeds yielding a red colorant when dried and processed. Used extensively in the industrialized world for colouring such food products as Cheddar cheese, achiote has experienced cycles of demand in recent years on international markets.

Despite the fact that IBTA Agronomists can only identify 1 hectare of achiote in the Chapare (that in the La Jota station), it has been included in the non-traditional category because it is not a new crop to Bolivians. Achiote trees, although not planted in stands, are evident in many areas of the region where they are used for family consumption purposes.

IBTA places yields from the achiote (commencing in year 2, and entering full production in year 3) in the range of 1-1.8MT/Ha. depending upon husbandry techniques, planting densities and treatment (see Table 3.2). Criolla varieties yield twice per year but the improved varieties give a single harvest in September-December. La Jota has improved genetic stock sufficient for planting 20Has. of achiote, if demand exists.

Agronomic potential is said to be very good, with achiote performing well in areas of poor soils throughout the Chapare. Some farmer processing is required of the harvested seeds, involving a form of threshing.

Little data is available as yet concerning the proportion of Bixina (the active ingredient of achiote) present in the crop. Peru, a major supplier of achiote on world markets, would normally expect to have a Bixin content of 29-30% and a pH of between 4-5. Bolivian achiote must be of approximately the same standard if it is to be exportable.

Although all commercially available achiote in Bolivia now enters from Peru and wholesales for approximately Bs.2,000.MT., an achiote plant is said to have operated in Alto Beni until 10 years ago. No references have been found to this plant, however, and no-one appears to know why the plant ceased functioning.

Currently one local processor, Venado Industries, purchases bulk imported achiote and retails it in powdered form.

TEA (Té):

Tea production appears to have declined in recent years in the Chapare, falling from nearly 60Has. a few years ago to approximately 30Has. today. Half of the surviving area belongs to CORDECO, the regional development agency, while the other half is in the hands of some 30 small-scale producers belonging to a Tea Producers' Association.

UNFDAC agronomists estimated current yields at approximately 5MT/Ha. but were convinced that yields of at least 8MT/Ha. were feasible with proper husbandry techniques (internationally, tea averages approximately 10MT/Ha.).

Bushes are all of the Assam type derived from material imported from Taiwan and Africa and the output in the Chapare is claimed to be 1st grade.

The decline in production in recent years is said to be the result of high labour costs for harvesting (due to competition from coca) and the UNFDAC program is considering bringing in a mechanical harvester. Producers currently receive Bs.500/MT. but their output is not sufficient to meet national demand and tea is currently imported from Argentina. CORDECO owns a tea processing plant using Chinese equipment donated under a previous assistance project. In addition, facilities exist in La Paz for packaging tea in tea bags.

One restricting factor on tea production in the Chapare may be altitude. Current production is mostly occurring at around 200-300m, although there is some production at 600m. This may be too low for successful large-scale production.

COFFEE (Café):

The 40 member Association of Coffee Producers achieved their first harvest of coffee in the Chapare in 1989, collected from 40Has. of plants in production. UNFDAC estimates, however, place total coffee plantings in the region at nearer 300Has. (see Table 3.2).

All coffee planted in the Chapare is Arabica, mostly of the varieties Caturra, Catuai and Catimoro. Most known plantings are in the altitude range of 300-1,000m. Because the harvest was the first, the Coffee Producers' Association was not able to provide an accurate estimate of future yields.

- UNFDAC is developing 15 coffee de-pulpers for the Association at a cost of only US$800 each, which will permit the producers to sell their coffee as green beans. No price structure has yet been established for Chapare coffee as production last year was insufficient.

LEMON GRASS (Pasta de Cedron):

Lemon grass (Cymbopogon Citratus) is one of a group of plants, including mint and spearmint, cultivated for the essential oils they contain. Lemon grass yields primarily citral, which is normally contained in the oil at a concentration of 65-85%. Citral is used primarily in drinks, foodstuffs, cosmetics and perfume products.

Approximately 40 Has. of lemon grass are currently grown in the Chapare, 4 Has. of which were planted in 1989, yielding an average of 56MT of grass/year over 4 cuts (Table 3.2). All Chapare lemon grass has been grown from seed imported from Argentina.

The limiting factor on lemon grass production is processing capacity and the liquidity of Agroquimico, the CORDECO/University of San Simon joint-venture which purchases the crude oil for the purpose of extracting citral.

Currently processing takes place in a small plant in the Chapare equipped with a steam generator and three extractors (only one of which is working). Growers operate the equipment themselves, processing their own product, and sell the resulting crude oil (to Agroquimico) at

US$6/Kg (Bs.18,500/MT). Agroquimico is currently offering 92% citral on the world market at US$15.50/Kg. FOB Cochabamba.

Total crude oil production currently runs at 9-12MT/year, although with all extractors functioning it would be possible to produce from 50-90MT/year, signifying 250-400Has. of lemon grass. The existing distillation equipment yields 4Kg. of oil per MT of grass, which is below international levels of 6Kg/MT, but this may be improved substantially with better equipment.

The second limiting factor is Agroquimico's budget, which restricts the amount of funds it can afford to have invested in lemon grass oil stock at any one time.

To alleviate both of these problems, Agroquimico is proposing the development of an integrated oil and essence extraction facility. Costing a total of US$5.5 million, the proposed plant would produce 50MT of lemon grass oil and 60MT of citral per year, among many other oils and extracts, and would lead to the cultivation of an estimated 12,000Has. of new crops (Programa Agroquimico, 1990; p.16). The proposed operation would be constituted as an independent company with minority CORDECO/UMSS ownership.

On a more modest scale, UNFDAC is considering investing funds in the improvement of Agroquimico's cash flow and in the rehabilitation of the existing extraction equipment. The lack of an official ownership structure for the existing facilities are creating problems for UNFDAC in this second area, however. The processing facilities (containing the steam generator and extractors) appear to have no legal owner. CORDECO, the Growers' Association and Agroquimico could all lay claim but none seems to have any evidence. Meanwhile the growers continue to use the facilities - providing all the labour themselves when they process the grass - but without maintenance, the condition of the facilities is deteriorating rapidly.

COCOA (Cacao):

Cocoa has probably suffered more than any other crop in the Chapare from a lack of organization in the agroindustrial marketing system. A sizeable area of cocoa is reputed to have been planted previously in the Chapare, but lack of processing facilities, technical assistance or market contacts is said to have led to much of the plantings being cut down by frustrated growers.

Current estimates place acreage at approximately 20-22Has. of which nearly 7Has. belong to members of the Cocoa Growers' Association. According to the IBTA Agronomist no cocoa is currently in production in the Chapare but previously yields of only 0.3MT/Ha.of dry beans (2nd quality) were obtained using primarily Jamaican stock.

Both IBTA and the Cocoa Growers' Association argue that 1st quality production is possible and point to the phenomenal success of the El Ceibo Cooperative in Beni which has 800 members and processes output from some 3,500 growers cultivating 13,000-14,000Has. The cooperative operates two processing plants in the Beni as well as a warehouse and chocolate factory in La Paz.

La Jota is currently working with a number of hybrids derived from Ecuadorean plant material and is encouraged by growth rates.

3.2.2 Valles Altos

The introduction of non-traditional crops in the Valles Altos has been limited by water availability, particularly for crops requiring irrigation (see Section 2.1). Nevertheless, some non-traditional crops have established themselves in recent years including grapes, cumin, chirimoya and avocado.

GRAPE (Uva):

Grapes were established in the Valles Altos as a result of a joint IBTA/Swiss Aid project in the late 1970s. Originally some 35 Has. were planted (Navia, 1990;p.5) but it is generally agreed that this figure has declined to approximately 15Has. today spread among 35 producers. The COPLACO estimate (see Table 3.2) is generally considered unrealistic.

The majority of the current area is under Muscatel, with some Torrontez and limited quantities of Alfonso La Valle, Cereza, Pedro Ximenez and Negra Criolla, all grown for table consumption. PRODEVE estimates of yields as high as 8-10MT/Ha. are much higher than most other estimates - a recent survey placed yields at between 2-3MT/Ha. (Navia, 1990;p.5) - and probably reflect performance in the early years when full project support was available in terms of inputs, technical assistance etc. Plant densities are estimated at approximately 2,600/Ha. in most plantings.

IBTA maintains a specialized substation in Mizque (PRODEVE) devoted specifically to viticulture with staff specializing in agronomy, economics and extension services.

The decline in grape production in recent years is closely linked to the increasing presence of Chilean grapes on the Bolivian market. Largely seedless varieties, the Chilean grapes have provided strong competition for Valles Altos production, which is harvested primarily in December and January.

Current prices are quoted by Navia (1990;p.14) at Bs.1400/MT at farm gate, and approximately Bs.1,800MT when sold directly by farmers in Cochabamba, while Santa Cruz wholesale prices for produce from Tarija Department averaged about Bs.1,100/MT over the six months to February 1990.

CUMIN (Comino):

Cumin production is estimated at as much as 50Has. by the CORDECO study, but given the bias of the study towards the more densely populated areas, this figure may be an overestimate. IBTA staff place the area at nearer 20Has. Yields are given as between 450-800Kg/Ha., resulting in a total output in the region of perhaps 15-20MT/year.

Although little data is available concerning its cultivation, local agronomists report good performance and limited exports to Argentina in recent years.

Wholesale prices as reported by IBTA staff have been in the region of Bs.7,000-10,000MT with the higher end being more typical of Santa Cruz, than in the producing regions.

CHIRIMOYA (Chirimoya):

A temperate fruit with a distinctive and attractive flavour, chirimoya is just beginning to become known in the industrialized countries. Although Chirimoya have been a traditional tree in the Valles Altos region, it is only recently that serious attention has been paid to their commercialization.

Yields are estimated in the 6-10MT/Ha. range for established trees and are well adapted for semi-arid conditions, although the Cooperacion Internacional agronomist indicated that sufficient water must be available at flowering time for effective pollination to occur.

COPLACO estimates Valles Altos plantings of chirimoya at 64Has. although there are relatively few pure stands of the tree.

Prices for chirimoya fluctuate widely, ranging by Cooperacion Internacional's estimate between Bs.1,000-2,000/MT.

AVOCADO (Palto):

COPLACO estimates that there are some 35-40Has. of avocado, primarily of criolla variety in production in the Valles Altos. Yields are placed at around 4MT/Ha. by the same source.

No weight equivalents are available for avocado but prices averaged Bs.30/100 units in the wholesale market in Santa Cruz in the six months to February 1990.

3.3 Potential New Crops

The category of potential new crops is by far the most speculative section within this chapter. Although some crops have entered extremely limited commercial production (e.g. black pepper, passion fruit and anise) others have not even been developed far enough to provide reliable yield estimates. Still others have been grown in the past (e.g. olives) and have since been abandoned, while some are grown traditionally (e.g. tuna) and even marketed to a limited extent but have little attention until recently as serious commercial crops.

Nevertheless, all crops listed below have been suggested or recommended by local agronomists, project staff or other individuals with an intimate knowledge of the two regions, and all appear to possess moderate or strong potential for the Chapare and Valles Altos regions.

Selection of the 19 short-listed crops below was undertaken based upon the following key factors:

Promising small-scale production results from experimental farm plots and/or scattered producers

Reported agroclimatic requirements similar to those of existing crops cultivated in the regions

Strong performance in neighbouring countries or other areas with similar agroclimatic conditions

The presence of one or more of these factors justifies some degree of consideration for market potential, either at a national or international level. A separate list of potential crops which, for one reason or another did not qualify for the short-list, is presented in the Market Studies volume (Volume II) of this report.

It must be stressed, however, that, even where market potential appears good, considerable further research will be required for most of the crops mentioned below in areas such as growth rate, yield, disease susceptibility and quality of product before a firm recommendation could be made to proceed with development activities.

The crops/products identified for the two regions are summarized in Table 3.3 and comprise:

CHAPARE:

- Passion Fruit (Maracuyá) - in limited production
- Carambola (Carambola) - first trees entering production
- Naranjilla (Naranjilla) - experimental
- Soursop (Guanabana) - first trees entering production
- Black Pepper (Pimienta Negra) - in limited production
- Cardamom (Cardamomo) - experimental
- Cayenne Pepper (not tested)
- Allspice (Pimienta Gordo) - not tested
- Mint (Menta) - experimental production
- Freshwater shrimp (Camarones de Agua Dulce) - not tested, successful in Peru
- Spearmint (Menta Piperita) - experimental
- Macadamia (Macadamia) - small-scale production

VALLES ALTOS:

- Tumbo (Tumbo) - a high altitude relative of the passion fruit, tumbo is a recent addition to the range of a local drinks manufacturer
- Prickly Pear (Tuna) - a traditional crop, limited commercialization in Valles Altos
- Anise (Anis) - limited production
- Oregano (Oregano) - limited production
- Culanthro (Culantro) - limited production
- Garlic (Ajo) - traditional crop, limited production in Valles Altos
- Jalapeno Pepper (not tested)
- Cochineal (Cochinil) - experimental, successful in Peru
- Olives (Aceitunas) - previously grown in Valles Altos
- Eucalyptus (Eucalypto) - widely used for timber and fodder

TABLE 3.3: NEW CROPS WITH POTENTIAL FOR PRODUCTION IN THE CHAPARE & VALLES ALTOS REGIONS OF BOLIVIA

CROP TYPE	CURRENTLY IN PRODUCTION	AGRONOMIC POTENTIAL	OBSERVATIONS
CHAPARE:			
Passion Fruit	1.75 Has.bearing in La Jota 40 Has. to be established in 1990 Assn.of Producers (60 members)	Yielding 17MT/Ha (Flavicarpa Amarilla) Planting material for 100 Has. available	Some disease problems observed
Carambola	0.5 Has. between La Jota and 3 local producers	Yields of 22MT/Ha. Harvested in 1st year Many trees in Beni	
Naranjilla	Less than 3 Has. in production (Solano-topiro Quitoense)	No adequate yield data available. Current plants brought from Beni.	Not widely known in Bolivia. Market difficult.
Soursop	1 Ha. planted in La Jota. Entering production in 1990.	Expected to yield 40MT/Ha. but harvest only in 4th year.	Costa Rican stock
Black Pepper	4 Has. between La Jota and local growers. Balancota & Caliball varieties.	1st harvest yield at 1.25MT/Ha. (green) - more in La Jota. Material for another 28 Has.	Harvest in 3rd year only. Requires fungicide.
Cardamom	0.5 Has. in La Jota only. Growing Malabares	No yield data yet. Appears to grow well.	Requires 800-1500 meters for best growth.
Cayenne	No experience	Should be suited to areas used for pepper etc.	No available planting material.
Allspice	No experience	Should be suited to areas used for pepper etc.	No available planting material.
Menta	Experimental only - production planned		
Freshwater Shrimp	No experience	Raised in Peru	Larvae supply may be limiting

TABLE 3.3: NEW CROPS WITH POTENTIAL FOR PRODUCTION IN THE CHAPARE & VALLES ALTOS REGIONS OF BOLIVIA (Cont'd)

CROP TYPE	CURRENTLY IN PRODUCTION	AGRONOMIC POTENTIAL	OBSERVATIONS
VALLES ALTOS:			
Tumbo	Widely distrib. but not on commercial basis		Del Valle purchasing fruit in small quantities
Prickly Pear (Tuna)	Widely distrib. but not on commercial basis	Also required for Cochineal production	
Anis	Limted production - no data	2MT/Ha. quoted by DESFIL 1987	
Oregano	Limted production - no data	No yield data	
Culantro	Limited production - no data	1.5MT/Yr. quoted by DESFIL 1987	
Garlic	Limited production - no data	6MT/Ha. quoted by DESFIL 1987	
Jalapeno	No experience	Should grow in Valles Altos	
Cochinile	Experimental	Yields of 100Kg/Ha or better expected	Needs sheltered conditions. Beetle supply may be problem
Olives	Scattered trees	Climate suitable - no yield data	Current trees grow well

3.4 Conclusions

It is not the intention in this part of the study to determine the suitability of existing and potential crops for development within the Chapare and Valles Altos regions; that aspect of the study requires consideration of market potential that will only be covered subsequently in the separate Marketing Studies volume. Here, the objective was only to indicate those crops that appeared to possess agronomic value, and to provide some brief details of the data available with respect to each crop.

Nevertheless, it may be useful at this point to draw some general conclusions relating to the crops discussed in this section. Firstly, it is obvious that there is no shortage of suggested candidates for development. In particular, the short list of potential crops - all twenty two of them - could have been expanded considerably further had some crops already excluded for reasons of probable lack of agronomic suitability been explored further. Crops excluded at this early stage included a wide range of different species including sesame, silk worm, kiwi fruit and pyrethrum.

Secondly, with some notable exceptions, it can be seen that many of the existing and potential crops can be grouped into a number of major categories. These categories are important because they render the work of assessment and market studies much easier - by reducing some 30 crops and species to approximately a half a dozen key groupings. These grouping include:

HERBS & SPICES
- Turmeric
- Ginger
- Cumin
- Black Pepper
- Cardamom
- Cayenne
- Allspice
- Anise
- Oregano
- Culanthro
- Jalapeno

FLAVOURINGS & COLORANTS
- Achiote
- Lemon Grass
- Mint
- Cochineal
- Garlic Oil
- Ginger Oil
- Eucalyptol
- Spearmint

TROPICAL FRUITS
- Papaya
- Pineapple
- Chirimoya
- Avocado
- Passion Fruit
- Carambola
- Naranjilla
- Soursop
- Tumbo
- Prickly Pear

CITRUS
- Oranges
- Mandarins
- Grapefruit

COMMODITIES
- Coffee
- Tea
- Cocoa

OTHERS
- Bananas
- Plantains
- Cassava
- Maize
- Potato
- Wheat
- Tomato
- Peanut
- Grapes
- Shrimp
- Olives
- Macadamia

Obviously, there is room for argument and discussion over the categorisation of the different crops or species - is, for example, turmeric a spice or a colorant? Despite these problems, however, such a set of groupings makes the originally lengthy list considerably easier to manipulate and investigate.

Thirdly, it is clear that even after more than a decade of involvement in the Chapare, and nearly three years in the Valles Altos, the state of knowledge of many aspects of the agriculture in these areas - just as for the state of knowledge of social aspects (see Section 2.2) - is very poor.

Data concerning yields, varieties grown, husbandry practices and areas planted are still often largely unknown. Even where data does exist, it is often so contradictory as to render it almost worthless - as Tables 3.1 and 3.2 clearly show. It is recommended that a major effort be devoted to increasing the body of reliable knowledge relating to these two areas with respect to agricultural production.

4.0 ACCESSING RAW MATERIALS

Agricultural production comprises the raw material of any agroindustrial operation. For the enterprise to work successfully, therefore, raw material supply must be an integral part of company operations.

In the previous Section a review was presented of the range and type of raw materials that might be available to an agroindustrial operation. In this section the focus is turned more to the manner in which the enterprise can be assured of getting that production from the field to the factory.

This facet of enterprise management has been divided into three key areas; the willingness of growers to respond to new raw material needs created by a processing operation; the methods by which that production may be collected and delivered to the plant; and the availability of credit and inputs to allow growers to participate fully in a new system. Each of these areas is considered below.

4.1 Farmer Response to New Production Needs

A key factor in obtaining adequate supplies of raw material for any agroindustrial marketing system is the responsiveness of local farmers to the needs of the plant or processing operation; especially when the required crops are non-traditional and require some risk taking on the part of the producer.

Two key factors govern such responsiveness - the degree of satisfaction of growers with their current product mix and the extent of their ability to change that mix. These two aspects are discussed in more detail below.

The degree of satisfaction of growers with their current product mix is dependent upon such factors as yields, prices and risk associated with the crops involved. It is in this area that previous efforts at crop replacement in the Chapare have failed. Until recently most growers were too satisfied with returns and security associated with the production of coca to seriously consider changing to other crops, despite the US$2,000/Ha. bonus offered under DIRECO to farmers eradicating coca plantations. One of the most hopeful indicators for the success of any new replacement efforts, therefore, is the dramatic decline in coca prices in recent months and the impact that this decline has had upon farmers in the Chapare.

While coca prices had reached astronomic levels in the mid to late 1980s (prices of as high as US$500/100Kg. of leaf have been reported), prices in recent years had appeared to have stabilized at approximately US$50-70/100Kg. Given the ability of coca to withstand up to 4 harvests per year, these sort of prices were yielding farmers net incomes of several thousand dollars per year, considerably in excess of any other crop except possibly intensive pineapple production (IBTA Chapare Agronomic staff estimates).

In the second half of 1989, however, coca leaf prices started to decline, reaching only US$15 in December of that year. By March of 1990 prices had reached a record low of only US$5-7/100Kg., a price level at which almost any other crop is more profitable.

The continuance of such low prices is obviously dependent on a number of factors, many of which are outside of the control of the Government of Bolivia and USAID, and prices may rise again in the future if demand increases once more. Even if prices do rise, however, the recent crash has severely damaged coca's reputation as a low risk crop. Farmers depending upon income generated by leaf sales are suffering real financial problems (as are the many casual workers employed by the cocaine industry).

Thus while coca is unlikely to be eliminated completely from the Chapare in the near future unless prices stay low for a year or more, the current crash in leaf prices has provided a very strong impetus for diversification into new crops. It is likely that never again will the Chapare see such a dependence upon coca production as was the case in the second half of the 1980s.

An analogous set of circumstances has also led to a strong desire for diversification in the Valles Altos. Here, however, it is not so much prices (although for such crops as potatoes this is definitely a factor) as drought conditions and repeated crop failures on non-irrigated land that has led to this drive. Growers in the Valles Altos not only need improved and extended irrigation systems, they also need crops better adapted to the semi-arid conditions which prevail there than is the case with potatoes, maize and wheat.

More than willingness is needed, however, for growers to achieve a widespread diversification into new crops. Farmers must also be able to identify candidates (the key objective of this study) and marshall the resources needed to exploit those opportunities. Such resources include capital, operating funds, technical knowledge and planting material. The first two of these requirements is dealt with separately in Section 4.4 below but questions of technical knowledge and planting material will be addressed briefly here.

Any agroindustrial operation proposing to establish operations with a supply source in the Chapare or Valles Altos gains one significant advantage; the existence of the PDAC and other government and USAID supported institutions involved in providing just these sort of services. Apart from credit, these groups can assist in extension services, applied research and plant propagation, as well as potentially being involved in post-harvest training and other educational areas.

Such services would be available without cost to an agroindustrial operation, although the company might have to share the field staff with other processing groups handling other crops. The financial benefit of such an arrangement to a commercial operation could be considerable.

Once feasible crop alternatives have been defined, therefore, dependent agroindustrial enterprises can expect both willingness and ability on the part of local growers in raw material production.

4.2 Raw Material Supply Systems

Effective and timely delivery of raw material requires an organized supply system. Three basic approaches are commonly used to develop and maintain such a system. Firstly, the agroindustrial enterprise may produce all necessary raw materials internally, through a farm or plantation owned and controlled directly by the business. Secondly, supply may be organized and controlled directly by the plant through supervision and purchase of material directly from individual growers. This

approach frequently involves the use of forward contracting and company employed extension staff. (A nucleus farm/outgrower system, combining the first two approaches, is also commonly used). A third and more economical approach from the enterprise's point of view is to leave the supply aspect to others and simply act as a buyer. In this case other groups must plan, supervise, collect and deliver the requisite material. These groups may include cooperatives, farmer associations or producer groups. Each of these approaches is discussed below in the context of the Chapare and Valles Altos regions.

4.2.1 Company Owned Production Units

The ownership of its own production units for raw material obviously provides an enterprise with the highest degree of control possible over all aspects of that supply. Factors such as timing, volume, quality and price all fall directly under the control of the processing operation. For this reason, this model is the one historically selected by major international agroindustrial firms for their international operations.

The drawbacks to the ownership route are, however, significant. Considerable amounts of capital resources have to be devoted to the purchase and operation of the farm or plantation. Sufficiently large blocks of land must be available so that production volumes are adequate for plant needs. Most important of all, companies which have developed through the management of processing operations must extend themselves into agriculture; an area in which they may have neither skills nor experience.

In Bolivia, the scale of operations undertaken by most agroindustrial plants currently functioning is such that ownership of production areas is usually not a feasible option. Nor do any of the processing firms have any significant experience in agricultural production. These constraints might be overcome, however, should a major joint-venture or international supply contract be established, providing both large scale operations and previous experience in agricultural management to the Bolivian processor.

A final problem lies in the ability of any enterprise, national or foreign, to assemble a sufficiently large block of land to feed a major processing plant. Land in reasonably large blocks is available in the Chapare and more is likely to become available as the conversion process from coca continues. During the field visit of the AMIS team, for example, a block of 800Has. was being offered for sale in the Ivirgazama area. It should be noted, however, that this is often the poorest land and has, in addition, generally been monocropped to coca for some years previously. Coca is reputed to severely deplete soil nutrient reserves and, hence, reduce the future value of the land.

In the Valles Altos the acquisition of large blocks of land is more problematical. Here most land was distributed to local campesino families under the agrarian revolution in 1952 and much of it has since been sub-divided through inheritance and sale. Nevertheless, reasonably sized blocks can become available. A group of German investors interested in establishing a jojoba plantation, for example, managed to acquire approximately 1,000Has. in the Omereque region about 4 years ago (this land is also now up for sale).

Despite these examples, however, it must be admitted that the extensive blocks usually sought to act as dedicated suppliers to large internationally oriented processing operations would probably be difficult to assemble. Macadamia production, for example, is claimed to require some 3,000-5,000 Has. to justify a plant. Other crops may need even bigger holdings.

4.2.2 Direct Supervision and Purchase from Outgrowers

Where capital or land market restrictions render ownership of production estates infeasible, a second approach is to develop direct linkages with local producers. This method is often used in conjunction with 'core' estates, owned by the plant, that can provide at least part of the factories' basic raw material needs. Local 'outgrowers' then supply the remaining factory intake. In either case, the factory undertakes close control of the production process of those growers supplying the produce to the factory, often including the supply of planting material, inputs, technical assistance and machinery.

Direct control of the production process by the factory obviously brings many benefits. Future supply quantities can be estimated accurately, product quality can be tightly monitored and varieties grown can be tailored specifically to plant requirements. Depending upon the scale of factory operations, however, this approach can impose considerable organizational and administrative burdens on plant management.

In order to make such a system function successfully, the plant must maintain extension staff, quality control inspectors and probably personnel involved in input supply and areas such as disease control. In reality, the management burden is higher under the outgrower system than when the plant owns the production unit, because growers are no longer employees and must be persuaded to follow procedures required by the factory. There also exists the danger that growers will decide payments are not high enough and refuse to continue supplies or seek other buyers.

As far as can be ascertained, this system has not been attempted on any scale in Bolivia, although there are successful examples of its use in many other Latin American countries. Its introduction in the Chapare or Valles Altos would require a serious commitment by both processor and growers to the long term effort needed to render it workable. The task would be eased to some extent by the availability of extension organizations and NGOs operating in the two regions that could assist the plant in farmer education.

4.2.3 Supply Organization by Others

The method of supply procurement requiring least input by the processing plant is, of course, to let other groups or individuals undertake the work for you. At its simplest this method involves no more than announcing the fact that you are buying commodity 'x' and letting growers deliver directly to the factory gate. This is the system widely used in Bolivia by smaller processors of fruits, spices and other agricultural products. A variation on this theme is to provide the transport from the producing area but leave the remainder in the growers' hands. This method is used by Del Valle in their purchase of oranges and other fruit in the Yungas region. Here a truck makes a circuit of the area stopping at predetermined points to purchase offered fruit.

The disadvantage of these approaches is the absence of control exercised by the plant over incoming supply. Although the company can, of course, reject sub-standard or unsuitable supply, it has no say in production methods, quality, variety or timing except through its refusal to purchase.

An intermediate approach, therefore, is to encourage another group to take on this responsibility; outgrower management by proxy, so to speak. Usually this other group will be a cooperative, growers' association or community group operating in the production area. The big advantage of this method is that an organized channel is established through which requirements (variety, planting dates, chemical usage) can be passed to the growers. The group can also act as distributor for physical elements, such as planting material and inputs. Finally, and this is of no small importance, such groups are often eligible to receive grants and other government or international assistance that would not be available to a private sector firm.

In Bolivia there exist many producers' groups and farmers' associations. In most cases, however, these groups are relatively poorly organized with limited membership and management skills. There are exceptions to this rule, including the El Ceibo cocoa growers cooperative in Alto Beni, which numbers several hundred members and draws from several thousand producers. This group maintains its own transport fleet, processing plants and even a chocolate factory in El Alto, La Paz.

Unfortunately, none of the groups identified within the Chapare or Valles Altos fits this pattern. The majority have membership of only 30-40 members and lack assets, structure or a clear sphere of operations. Only a few are directly involved in product supply, among them the Lemon Grass Producers' Association and the Tea Producers' Association. Neither pursues activities in extension, quality control, or input supply.

Any serious attempt to develop a viable agroindustrial sector based upon raw material supply coordinated by producer groups and the like will require a commitment from USAID and the Bolivian government to assist in the provision of technical assistance to these groups. Such assistance will be needed primarily in two areas: extension to growers and training of producer association management. Direct extension efforts could (and should, where the scale of operations is expected to be large) be combined with training of extension staff within the producer association, so that in the future the association can take charge of its own farmers. This is obviously only possible where sufficient producers (and earnings) are involved to support the extension workers' salaries, but is the preferable solution in the long run.

4.3 Conclusions

Judging by both coca leaf prices and the responses of growers interviewed during the field trip, the willingness of growers in the Chapare to participate in diversification efforts into new crops is currently at a level that has not been seen since the inception of government and USAID efforts in this area. Equally, the continued below normal rainfall conditions in the Valles Altos region, combined with declining markets for traditional produce, has produced strong pressures in that area for change also.

Guaranteeing an adequate supply of raw material, however, is more problematical. While ownership of blocks of land sufficiently large to supply a processing operation may be feasible, it

is likely that an agroindustrial enterprise would have to depend at least partially, and perhaps entirely, upon outside, campesino suppliers. In order for this supply system to work, considerable attention will have to be given to the provision of reliable, accurate and timely information to growers with respect to production and post-harvest handling methods.

Entrepreneurs considering the Chapare and Valles Altos regions, however, have one strong advantage - the existence of the PDAC and a number of organizations funded and supported by the PDAC. These groups can, with some reorganization and perhaps strengthened funding, provide the type of production-level extension service that will be required, at no cost to the company.

These organizations lack skills in two key areas, however; post-harvest handling and group organization. Both are seen as essential to the effective development of a raw material supply capability within the target zones. It is recommended by the AMIS group that USAID, together with PDAC, give serious consideration to the funding of one or two long term positions attached to PDAC or some other group, that could provide instruction in these areas.

Where funds are available for two positions, one specialist should work exclusively with the producer groups and associations, instructing and assisting them in such basic areas as record-keeping, inventory management, accounting systems, and personnel management. The emphasis of such technical assistance must be on the creation of efficient and self-sustaining producer groups.

The importance of these groups should not be underestimated. Where functioning well, such organizations are capable of operating and maintaining efficient and reliable supply systems to the considerable advantage of their members. It is not an overnight process to develop this capability, however, and USAID should ideally enter into any funding commitment with a long term time horizon in mind - preferably as long as 10 years.

Nor should it be forgotten that a number of different groups will be involved. As one group appears to near the stage of self-sufficiency in organizational terms there will always be other groups just starting to establish themselves in new areas or with new crops.

The post-harvest handling input advisor may be a shorter term position, but it should still be viewed as one that will require input over a number of years. His/her task must primarily be one of developing a local post-harvest capability through the training of trainers and the creation of a dynamic post-harvest group. Ideally such a group should extend over more than one organization, so as to encompass the planning capability of PDAC, the ability to conduct field trials of IBTA, and the campesino-level activities of the NGOs within a single entity.

The types of activities and skills that will need to be developed include those relating to harvesting procedures, post-harvest treatments (including washing and the application of fungicides etc.), sorting and grading, storage - both on-farm and off-farm, the use of containers and packaging materials, and transport needs and constraints.

The post-harvest group will also probably require funding support for such areas as audio-visual equipment for training purposes, the construction of demonstration storage and handling facilities, trials with truck owners of different transport methods, and the sponsorship of graduate students wishing to undertake these in the post-harvest field.

Whether such a group would rely on regular extension staff to disseminate their message, or whether they should develop a specific field group of their own is difficult to decide at this point, but whichever route is chosen, funding will probably also be needed for vehicles.

5.0 FOOD PROCESSING FACILITIES AND CAPABILITIES

Food processing is no more than one branch of the manufacturing sector - albeit one with special constraints and requirements due to its dependence upon agriculture for its supply of raw materials. Before examining in more detail the processing sector in Bolivia, it is perhaps useful therefore to consider briefly the overall position of manufacturing in the economy.

With the overwhelming dominance of first mining, and more recently natural gas, manufacturing has not traditionally been a major element of Bolivia's economy, accounting for only 13.3% of GDP in 1988. It plays an even less important role in the foreign exchange earnings of the country; of total earnings of US$531 million in 1988, the value of manufacturing exports was too small to be recorded, while the category fuels, minerals and metals accounted for 93% of all exports (all data - Trends in Developing Economies 1989, World Bank).

Of the economic activity attributed to manufacturing, however, some 37% was accounted for by food and agriculture related activities. The manufacturing sector is also the most rapidly growing portion of the Bolivian economy; in 1988 it registered a growth rate of over 26%. The Cochabamba Chamber of Industry lists 219 members, of which some 42, or 19%, are registered as active in the food sector. These are primarily small companies, however; in total they employed only 940 employees in 1989, many of which would have been accounted for by the three major processing firms based in Cochabamba (see below).

5.1 Existing Operations and Equipment

In general, the limited population base of Bolivia, combined with the low level of per capita income, restricts the market demand for processed agricultural products. Domestically, only urban populations purchase such goods to any extent and even they can not generally afford goods that might be considered in the luxury category. Internationally, Bolivia has never developed any experience in exporting foodstuffs or other agroindustrial items, depending in the past upon the mineral sector.

The domestic situation is made more difficult by the ubiquitousness of imported products (often as contraband) in Bolivian markets. The strength of the Boliviano (Bs.), combined with the weakness of neighbouring currencies such as the Cruzeiro (Brazil) and Austral (Argentina), has made Bolivia an extremely attractive market for traders in neighbouring countries wishing to generate hard currency.

Few readily identified domestic markets exist that are large enough to support major commercial operations. Of the three key players in the agroindustrial sector in Cochabamba, two are dominant in soft drinks, largely fruit-based, which can be purchased in any cafe or bar throughout Bolivia, as is typical in most developing countries. The third is known primarily for meat products and preserves. Even these companies, however, are often divisions of larger holding companies or conglomerates which enables them to access capital and human resources more readily.

Most food processing operations in Bolivia are located in Cochabamba, however other significant agroindustrial operations have arisen in recent years in Santa Cruz, particularly in relation to soybean processing. Some processing operations also exist in La Paz, primarily for the handling of products grown in the Yungas region, and in Tarija, where the domestic brandy industry is established based upon local grape production.

After the major players, there are few other participants in the agroindustrial sector in Cochabamba or other cities of any commercial significance. Realistically, the domestic market simply can not support them. Most that do exist have other outside interests, as is the case for the major companies. Instead, there are a large number of small artesanal operations which survive by maintaining low overheads and production costs and producing relatively small quantities of product.

The DAA Consult team, which undertook a survey of Bolivian agricultural processing operations, were asked to identify companies operating in the following areas:

- Fruit Processing (Pulps, Juices, Nectars, Slices, Drinks etc.)
- Animal Feed
- Spices and Condiments
- Flavourings and Colorants
- Tomato Products
- Cocoa and Chocolate Products

In addition, the consultants were asked to review the use of freezing as a processing operation.

The DAA staff found no currently operating, dedicated industries in several of the above areas, including feeds manufacturing and tomato products. In the latter case, however, Dillman claims to operate a tomato products line which is not available to public inspection. They also found no evidence of any operating freezing plant, although, once again, Dillman may be installing capacity in this area. There is also a considerable presence in the dairy sector, primarily through the ownership by regional development agencies (e.g. CORDECO and CORDECRUZ) of government funded dairy plants.

Two active areas of agroindustrial activity were not examined in detail by either the AMIS team or the DAA Consult team due to their lack of direct relevance to the Chapare or Valles Altos areas. Firstly, soybean processing plants exist in both Cochabamba and Santa Cruz (particularly the latter, given the importance of soya as a crop in the Santa Cruz area) and produce most of the domestic vegetable oil supply. Significant processors include Industrias de Aceite (IASA) in Cochabamba and Sociedad Aceitera del Oriente S.A. (SAO) in Santa Cruz. Secondly, livestock processing, in terms of slaughter, tanning, and simple meat processing operations accounts for a number of smaller operations

In those areas where industrial activity does exist, it is important to distinguish between companies running simple packaging operations (e.g. VENADO, a major vendor of condiments does no processing but only repackages bulk imported items) and those actually processing raw materials. A intermediate position is represented by the fruit processing enterprises (see below), who do process, but confine their efforts almost exclusively to imported raw materials.

Actual processing of domestic production then can be limited to some cases within the fruit, spices and herbs, flavourings and colorants and chocolate sectors. Even in these cases, however, the bulk of the activity (in terms of number of firms) can be accounted for by artesanal operations.

In the following paragraphs a brief description is provided of some of the agricultural processing operations functioning at the time of the AMIS team visit. The list should not be taken as exhaustive - a more complete listing is provided under the DAA Associated Report in Annex III - but rather represents for the most part those visited personally by the post-harvest/processing specialist while in country. Although not claimed to be necessarily typical of all Bolivian agroindustrial operations, the sample described was selected in an attempt to obtain a range of processing operations.

The major exception to this principal was in relation to the three major processors in Bolivia. While detailed discussions had been held with these companies during the first field visit in December, it was apparently impossible during the March visit to find the right opportunity for a plant visit and data concerning their operations is derived solely from the supporting DAA study.

For ease of presentation, material relating to these operations has been divided into major operations (only three companies), mid-size operations (those with full plant operations, albeit on a minor scale), and artesanal operations (those using primarily family labour and their own households or other small facilities for processing).

5.1.1 Major Processors

There are three companies in Bolivia involved in the agroindustrial sector which might be described as major participants in the sector. Dillman, based in Cochabamba, is best known for its processed meat products, but is a significant presence in a wide variety of other food products. Del Valle, also based in Cochabamba, is smaller but focuses more exclusively on drinks and beverages. Finally, VASCAL (also Bolivia's Coca-Cola franchise), based in La Paz, owns SEASA, a Cochabamba based fruit drink operation selling under the name of Frut-All.

Unfortunately, with few exceptions, fruit and fruit flavoured beverages are derived from imported supplies. Only in the case of some oranges from the Yungas and some Tumbo from Cochabamba does Bolivian agricultural output enter the national agroindustrial sector as a component in drinks.

DILLMANN (Cochabamba). This commercial firm packs canned fruits such as strawberries, grapes, peaches, etc., as well as marmalade, canned meats, and pickled cucumbers. Founded in 1922, the company operates 5 plants including a slaughter house, fruit and vegetable processing, meat processing, dry products and tin can manufacture. Dillmann also owns some 300 retail outlets in Cochabamba plus others in Santa Cruz and La Paz and a 17 truck delivery fleet. According to the 1989 Sustain Report (p.33), their business is divided into 10% fresh meat, 50% sausages and 40% canned products. One of Dillmann's officers stated to the AMIS team, "Dillmann is assembling a tomato paste line, a frozen vegetable line, and also facilities for drying, grading and packaging spices and condiments." The information below was supplied by Dillman in written form in response to the DAA Consult survey and describes existing operations, although Dillman is not generally associated with either tomato or pineapple products. According to the Project Sustain report (1989; p.33) the Tomato paste concentrator is used for jams and jellies.

Product	Description	Brand	Capacity
Tomato	Processing line with a double-effect concentrator	Manzini Italian Industry	3,000 Kg/hr fresh tomatoes
Pineapple	Processing line	FMC (USA company)	1,000 Kg/hr fresh pineapple

INDUSTRIAS DEL VALLE (Cochabamba). Del Valle makes use of both domestic and imported fruit, although it claims that the cost of local supplies is such that the product is generally not competitive. Oranges, for example, are derived from the Yungas area, close to La Paz, at approximately Bs.1.5/100 oranges. Chapare supplies, when used, were costing nearer Bs.4-5/100 pieces. Leaving aside any quality concerns, Del Valle estimates that local citrus prices would have to decline below Bs.1/100 to match Brazilian supplies. The plant has three basic production lines.

- Product Line: Fruit juice
  Capacity: 2,400 Kg of fresh fruit per hour
  Operations: 10 percent of capacity

- Product Line: Preserves and fruit pulp
  Capacity: 4,000 Kg/hour
  Operations: 30 percent of capacity

- Product Line: Juices in 300ml and 1,000ml bottles and in Duo-Pak sachets
  Capacity: 4,000 litres/hour
  Operations: 50 to 60 percent of capacity

The equipment age and country of origin is as follows. The fruit washer is 20 years old and was made in the U.S.A. The jam kettle and fruit pulper machines are 14 years old and came from Argentina. There is a double-effect evaporator used to concentrate fruit juices that has become a limiting factor because of its small capacity. This plant also has a Danish juice pasteurizer and a filler and bottle-capper machine, both made in Argentina and purchased 6 years ago. The 6-filler type Duo-Pak system is only 2 years old.

According to information in the Project Sustain report (1989;p.34) Del Valle concentrates fresh fruit juices in season to 25° Brix, pasteurizes it and hot fills plastic 25 litre jugs for storage until needed. The Duo-Pak pouches, utilized in 230ml and 1,000ml sizes, are imported from Israel.

As of late 1989, Del Valle was seeking a bank loan US$50,000 to increase their ability to purchase large quantities of fruit when in season.

S.E.A.S.A (Cochabamba). Only this firm,a subsidiary of Vascal, packs fruit juices aseptically. It also manufactures yogurt. Most of the juices, with the exception of Tumbo are imported in concentrated form and later diluted (1 to 5 or 1 to 6). Current production is 425,000 litres (single strength) per year.

The Tetra-Pak equipment used by S.E.A.S.A. was manufactured in Sweden and installed in 1989. It aseptically forms, fills and seals 250cc- and l-litre packages. The 1-litre Tetra-Pak line produces approximately 3,750 brick-type packages hourly while the 250cc line fills 4,500 packages per hour. A separate machine applies plastic straws to the 250cc containers at approximately 4,500 units per hour. A packaging machine wraps a thermostretching plastic film around groups of twenty-four 250cc units or twelve 1-litre units. The hourly production is 8,000 units. Six juices are currently packed, including apple, peach, apricot, orange, pear and tumbo. With the exception of tumbo, all are imported (mostly from Chile) as 32° Brix pulps.

Other equipment used in the preparation of products is as follows. A Gaulin homogenizer that runs at a speed up to 6,200 litres per hour. This apparatus was manufactured in 1990. An Alfa-Laval plate-type pasteurizer with a capacity of 6,200 litres hourly. This unit was purchased in 1989.

The following equipment was manufactured in Bolivia: five stainless-steel surge tanks thermostatically adjusted for incubating yogurt, a juice extractor especially made for Tumbo fruit, an air compressor, a cooling tower and a water treatment unit used for filtration and purification.

Industrial Dairy Plant (PIL) (Cochabamba and Santa Cruz). These government established plants, two of five plants now turned over to the regional development agencies, are both capable of handling in the region of 60,000 litres of milk per day. A French Prepac bagging machine is capable of filling up to 4,000 litres/hr. They also have the capacity for manufacturing dried milk powder, evaporated milk, condensed milk, yogurt, ice cream and simple cottage-type cheese. Milk processing equipment is Danish and includes plate pasteurizers, homogenizers, cream separators and a spray drier. In addition, the Cochabamba plant is involved in providing assistance to local dairy farmers, including the importation of improved dairy stock from Uruguay.

Supply of fluid milk exceeds demand in both cities, resulting in the conversion of considerable quantities of fluid milk to powder, which is stockpiled in large quantities. Apparently, political considerations exclude the plants from refusing to purchase liquid milk at the moment.

Privatization of both plants has been discussed and is officially being considered by government. The question of excess supply presents a major obstacle in this area, however. Other dairy processing plants operating in Cochabamba include EMPAL and Nordland, both of which manufacture yogurt, ice cream and cheese.

5.1.2 Medium-Sized Agroindustrial Operations

Relatively few companies fall within the medium category, and most of those are within the chocolate products category, although one company, COBOCE, does operate within the area of fruit products. This lack of medium sized operations is indicative of a major weakness in the Bolivian agroindustrial sector - the volume of business is so limited that few opportunities exist for independent commercial operations. Even COBOCE, the only identifiable medium-scale processor within the fruit sector, is essentially a cement producer and is involved in agro-processing only as a sideline to its principle business.

ENAVEL-COBOCE (Santa Cruz). The COBOCE cooperative was founded to manufacture cement and has grown to be one of the largest cement companies in Bolivia. More recently COBOCE has extended its activities into a number of other areas, including housing construction and development, pharmaceuticals and agroindustry. Through ownership of the ENAVEL plant,

located outside of Santa Cruz, ENAVEL possesses facilities for processing and packing canned sliced pineapple in juice, as well as for the manufacture of a range of preserves including orange marmalade, strawberry jam etc.

The pineapple line has a machine that removes shells, cores and fruit ends. Trimming is done manually. Another machine cuts the pineapple in slices, which are placed by hand into cans. Syrup made by mixing juice (from crushed pineapple cores) with sugar (20° Brix to 40° Brix) is added into the cans. Thereafter, the cans enter a team tunnel where air entrapped in the product is exhausted before placing the cover or enclosure. The final step consists of immersing the can in water at 212°F, where they are sterilized by moving on a belt at regulated speed. Labelling of cans is done automatically.

Prior to ownership by COBOCE, the ENAVEL plant exported canned pineapple to Northern Argentina, but problems of quality (particularly of the cans used), as well as rising prices for raw materials, led to a cessation of exports. The pineapple line has not operated since its purchase by COBOCE in 1988, although COBOCE is keen to reactivate its operations as well as to expand into new areas if markets can be identified.

Preserves (jams) and marmalades are a separate operation. The equipment available consists of a mixing tank, a hammer mill, positive-displacement pumps, an autoclave and a single-effect vertical evaporator that concentrates products up to 65° Brix at speeds of 900 Kg per hour. There is also equipment for filling and sealing jars. At the end of the preserves line is a Selo-Vac tray-forming machine with 4 fillers. The capacity is 80 units per minute. It was purchased 5 years ago. This line is currently operating.

The boiler generates 5,000 Kg (120,000 lb) of saturated steam per hour. It was manufactured in Argentina in 1972. The plant also has a 20-cubic metre cold-storage room and processes and packs a variety of meats, including frankfurters, sausages and related items.

CORONA (La Paz). This food plant manufactures different types of chocolate products. The equipment is old and so is the overall appearance of the plant. Coloured aluminum foil is used for wrapping chocolate pieces of different shapes and sizes. The latter are sold in plastic bags or boxes.

Other chocolate plants located in different cities are as follows: INCADES (La Paz), COOP. El CEIBO (La Paz), PROCAO (La Paz), INCOMA (Cochabamba) and PRINCESA (Santa Cruz).

PROGRAMA AGROQUIMICO (Cochabamba). This operation is atypical in that it is a joint-venture between the University of San Simon in Cochabamba (UMSS) and the Departmental Development Corporation (CORDECO) and is not a fully commercial operation. The project has its headquarters on the university campus, although its funding is largely independent of the university and includes earnings from the sale of products.

Current commercial offerings of Agroquimico include up to 7MT of Eucaliptol (99.5%) and 12MT of Eucalyptus Oil (80%), 5MT of Citral (92%), 10MT of Lemon Grass Oil (75% Citral) and 1MT of pyrethrum extract (25%), all per annum.

In the field, Agroquimico maintains a number of crude oil extraction facilities, including 5 $1m^3$ extractors and 2 $4m^3$ extractors for eucalyptus oil and 3 $5m^3$ extractors for citral. On the university campus, Agroquimico operates an 8m distillation /fractionating column of 6" diameter,

a 5HP, 3,000RPM centrifuge and 7 domestic type freezers, each of 0.5m^3 capacity. Agroquimico also maintains and operates a full quality control and assurance facility (see Section 5.4).

A number of Agroquimico's pieces of equipment are locally fabricated, including the extractors and the centrifuge.

5.1.3 Artesanal Manufacturers

The artesanal manufacturers represent probably the most dynamic aspect of the Bolivian agroindustrial sector. Due to their small size, low overheads (frequently an extension of the owners' houses) and use of family labour, these operations are able to compete effectively with competing (and often smuggled) imports.

The team was impressed by the quality of work being conducted at a number of these enterprises, with close attention obviously being paid to product quality. Nevertheless, such aspects as product hygiene were not always well controlled. In general, however, these plants were producing materials of a very acceptable quality level.

The disadvantages associated with the artesanal sector are many, however. Often using extremely primitive equipment and extensive hand labour, the enterprises are unable to expand for a number of reasons:

- Limited current market demand, together with insufficient knowledge of potential new markets, renders investment in better equipment or facilities too risky
- Lack of knowledge of food technology, packaging or engineering would render the use of more advanced equipment difficult for many entrepreneurs
- Restricted access to financing limits the amount of raw material that can be purchased, and hence the output of the processing operation
- Lack of knowledge of business management techniques, including accounting, inventory control, personnel management and business planning, limit ability of owners to expand successfully.

Some of the plants visited included:

INDUSTRIA LUZ (Cochabamba). This enterprise makes glazed fruits (orange, lemon, citron, papaya and pineapple)- known in Spanish as 'frutas abrillantadas', similar in size and colour to that used in American fruit cakes and cookies. The equipment used in this plant is very simple and the operation is sanitary. Glazed fruits are packed in plastic bags of two sizes and sold locally, primarily to bakeries for use in speciality breads. The product is of particular interest for export because it does not require refrigeration or other special transport measures.

KORR (Cochabamba). This enterprise processes spices and condiments such as black and white pepper, red and yellow pimento, garlic, parsley, cumin, bay leaves, coriander, ginger (ground) and several others. Spices are solar dried, cleaned, ground when required, and placed in plastic bags. The only equipment available was a hammer-mill grinder equipped with a large hopper, and various heat sealers for different types of plastic materials and bag sizes. Most of the work is undertaken manually.

LA GRANJA, S.R.L. (Santa Cruz). This small food plant packs pineapple products and also makes fruit preserves. Several operations are done by hand. From a sanitary viewpoint, it did not impress the writer. The owners are planning to pack low-acid foods (heart-of-palm, fish fillet and

grated fish) in the near future. The equipment varies in age between 10 and 40 years and is completely hand operated, including a can welder and sealer, pineapple decorers and peelers, and cooking kettles.

5.2 Management and Staffing Considerations

It is difficult to provide an assessment of staffing and management standards within the larger processing operations as the team did not have the opportunity to visit their facilities during their time in Bolivia. Nevertheless, the larger firms within the sector (Dillman, SEASA, Del Valle) are run as full commercial operations and can be expected to possess standard management and staff structure and procedures. It is considered likely that these firms are capable of undertaking their own training and management programmes as and when upgrading should be required. No USAID or PDAC support is probably required for these companies.

More attention is almost certain to be needed by the medium-sized and artesanal operations. In these cases the companies have neither the resources nor the structure within which to plan and undertake adequate training or upgrading programs. As is typical of such operations - particularly at the artesanal level - the management structure tends to be very thin. Often a single person (the owner) will undertake production supervision, accounting, planning and marketing functions. Under such a load upgrading skills becomes extremely difficult.

The needs of the smaller processing plants in terms of management and staff skills will obviously depend heavily upon the development strategy followed. Where fruit products are identified as having significant market potential, for example, training of smaller processors may not be a major issue as such activities are largely confined to the major companies within the sector. Assuming such companies continue to play the dominant role in this area, only limited training will thus be required. Outside of the fruit sector, however, there are no major processing companies active and significant assistance to processors will be necessary where growth is intended to derive from the development of artesanal or small firms.

Areas of training may include strategic planning, financial management, marketing, technology and personnel management.

5.3 Adoption of New Technologies

A similar argument to that put forward for management and staffing can be advanced for technology. Although some obvious technologies, such as Individual Quick Freezing (IQF) or spray evaporators, are not in use in Bolivia, the presence of other advanced technologies in the packaging sector (e.g. Tetra-Pak) demonstrate clearly the ability of the larger firms to make substantial investments where they believe returns are available. For the larger companies, therefore, the lack of investment probably derives more from an absence of secure demand, than from lack of knowledge or interest in new technologies.

Smaller enterprises, however, have no such ready access to investment funds, nor do they possess the resources to identify and investigate potential new technologies in their area. Interviews with many enterprise owners showed them to be painfully aware of the inadequacies of their present technological base but unable to develop an approach for successfully overcoming these limitations. While hand operated equipment may guarantee low operating costs and overheads at the moment, the successful growth and development of such small enterprises must inevitably involve the adoption of improved processing capacity at some point.

Any attempt to upgrade the status of these companies must focus directly upon the question of their technological capacity, and will thus require careful attention by USAID and PDAC to technology transfer. Among the procedures that might be used to accomplish this are the funding of a long term technical assistance position in technology transfer (possibly in conjunction with the training activities discussed in Section 5.2), the use of volunteers from the Peace Corps or the Executive Volunteer Service Organization, or the development of long term relations with groups such as Appropriate Technologies International (ATI).

Of course, the participation of major North American agribusiness firms in the Bolivian processing sector (either as buyers or as investors) may provide the most rapid route to successful technology upgrading among local processors. The foreign firms have an intimate knowledge of available technology within their fields and, as long as they are aware of the dangers of overly-rapid investment, could be of considerable assistance to local firms in suggesting appropriate equipment and facilities.

In recent years freezing technology has brought about a new insight into the potential for exporting whole fruits, which otherwise could not be sold in the international market. **Individual quick freezing** or IQF (also known as air blast freezing) has become a preferred method because it preserves frozen products' taste, colour and texture better than other commercial procedures.

No IQF lines currently exist in Bolivia, although a refrigeration engineer working in Bolivia on a volunteer basis suggested to the AMIS team that an ammonia based system capable of attaining temperatures of -40°F and with a capacity of approximately 1,000lbs./hr could be constructed in Bolivia for less than US$250,000. An ammonia-based IQF process would be more than capable of blast freezing smaller items such as raspberries, strawberries and other soft fruit. Such an operation would require a mixture of local fabrication and imported machinery in order to maintain costs at this level but would be achievable. A nitrogen based system, which would be necessary for IQF of larger items (corn-on-the-cob, for example) would be considerably more expensive, both to construct and to operate.

To justify spending a considerable amount of money such as that needed to build and equip a frozen food plant, a large quantity of fresh fruit is first needed. Unfortunately, high quality fruit is not readily available and it will take a few years to establish a well-developed fruit industry.

In addition to the money necessary for building a frozen food plant, there are other large expenditures to consider, such as construction of frozen storage warehouses at various locations and purchase of a fleet of refrigerated trucks to transport the merchandise. Moreover, if frozen products are to be exported by air, some extra charges cannot be overlooked.

5.4 Research, Development and Quality Assurance

Although internal testing laboratories are maintained by the larger commercial operations, there are no commercial testing facilities in Bolivia. For export goods some testing of products is possible through the presence of Bureau Veritas and Specialist Services International. These two organizations are contracted by the Government of Bolivia to conduct standard quality checks on outgoing goods, including weights and volumes, labelling and quality.

Because the checks performed by the government contracted agencies are essentially those related to legal requirements, such procedures are not sufficient for firms engaged in the production of products where quality is the key element in market demand. In such areas as spices, essential oils and fruit juices, measures of the percentage of active ingredients, presence of extraneous foreign materials, and proportion of water in the product can all be of prime importance to the saleability of the product.

Fortunately, testing facilities do exist within Bolivia at the university level. In particular, the Agroquimico joint-venture of the UMSS and CORDECO is reasonably well equipped to conduct a number of basic physical and chemical analyses. In addition, other university departments, both within UMSS and in other universities in La Paz, Sucre and Tarija, possess the facilities for biological and similar tests.

Briefly, current facilities in Cochabamba are as follows:

Agroquimico

Computerized Gas Chromatograph (Varian 3400), calibrated with LASEVE at the University of Quebec
Radial Chromatography Equipment (Phillips, U.S.A.)
Computerized UV-VLS Spectrophotometer (Perkin-Elmer)
Equipment used for other physicochemical analyses: density, refractive index, optical deviation and solubility
Chemical determination of generic components: alcohol, acids, aldehydes and acetones

Other UMSS Capabilities

Food Program (Chemistry Dept.) - Food analysis and sensory evaluation: fibres, proteins, fats, amino acids, carbohydrates, dry matter and ash, as well as taste, smell and texture
Nutrition Laboratory (Biology Dept.) - Analyses offered by the Food Program plus biological analyses

While the equipment listed above provides Agroquimico with the capability to undertake a variety of different physico-chemical analyses and tests, the lack of a number of pieces of specific equipment (e.g. a high pressure liquid chromatograph), as well as competing demands for staff times, means that Agroquimico is not currently in a strong position to provide testing as a regular service for outside companies. Despite these restrictions, however, Agroquimico is able to guarantee a turn around time of no more than 1-2 days for most analyses on a fee-for-service basis. Any substantial increase in demand for their services would require the development of a dedicated testing unit which is an impossibility for Agroquimico under current budget constraints. They are willing to consider such a move, however, where outside financial assistance is available for investment in the necessary testing equipment and facilities.

The problems faced by Agroquimico apply even more strongly to other university departments which have no independent financing. In the case of these departments, problems relating to staff availability or even university vacations can impede the provision of test results.

Technologically based research and development work is even more limited in Bolivia. Most agroindustrial enterprises simply lack the resources of skills necessary to undertake research programs and such work is restricted almost entirely to universities. The larger companies tend to buy their technologies directly from North America or other industrialized areas and devote few resources to undertaking in-country research. Any efforts to develop in-country research capacity will almost inevitably have to rest with the universities for the foreseeable future.

5.5 Conclusions and Recommendations

The manufacturing sector in Bolivia is still essentially an infant industry. Despite strong recent growth - much of it due to the collapse of the mining sector - manufactured exports are insignificant as a source of foreign exchange earnings for the Bolivian economy. Within the sector, however, agroindustry is of considerable importance, accounting for more than a third of all manufacturing value added.

As a result of a very restricted domestic market, limited sales opportunities exist domestically and only a few companies have managed to emerge as significant players in the market - primarily in soft drinks and fruit-based products. With few intermediate-sized enterprises in the marketplace, a strong stratification is evident in the agroindustrial sector.

The larger firms are apparently relatively well equipped in terms of technologies, even to the extent of operating a Tetra-Pak plant in the case of SEASA. Nevertheless, their emphasis upon the fruit drinks segment of the market has resulted in the absence of some technologies that would normally be expected, including IQF-based operations (although this latter may require a considerably expanded supply of appropriate fruits or small vegetables before investment becomes worthwhile). These larger companies probably have both the resources and knowledge to invest in alternative or newer technologies but are unlikely to do so unless they feel sure of the market targeted.

There is also an apparent absence of larger firms in several potentially key areas of the agroindustrial sector. A separate study, for example, could not locate any major players in animal feeds, tomato products, or herbs and spices.

Smaller firms, mostly artesanal, operate from a very primitive technology base, using primarily hand operated equipment and makeshift facilities. Despite these drawbacks, however, the resulting products are often of a surprisingly high standard, and it is this group of small-scale entrepreneurs who have the greatest drive to innovate and expand their operations. Not surprisingly they face considerable problems in terms of market penetration, financing (both operations and capital) and in business management. The involvement of these firms in agroindustrial development will require considerable attention to human resource development and technology transfer.

A second set of problems can be anticipated with respect to quality assurance of products destined for the export market. Bolivia does not possess adequate facilities for evaluation and analysis of products such as spices, oils, colorants or fruit pulps. The most likely candidate for the provision of this service is Agroquimico, but they will require some level of financial support to establish a fully equipped analytical laboratory for analysis of outside samples. They may also require some degree of subsidization in early years until the agroindustrial sector is sufficiently dynamic enough to afford the full cost of such services.

6.0 PACKAGING AND STORAGE

When assessing the feasibility of processing and marketing operations, packaging and storage are often regarded as secondary in importance to such aspects as raw material, technology and markets. Perhaps this is true. Nevertheless, the ability to adequately handle agroindustrial products once processed is an essential component of the entire system. In the case of Bolivia, where both packaging materials and storage facilities constitute real constraints to finished product delivery, the importance of these stages is even greater.

Generally, two issues must be addressed - the volume, form and wrapping in which the finished product will be shipped to customers, and the requirements of that product for special storage and handling facilities before and during its journey to the customer. Obviously, both aspects are interconnected; some types of packaging require special treatment (e.g. refrigeration or air freight), while others may permit ambient storage and handling over extended periods of time.

Both of these issues are addressed below.

6.1 Packaging Availability

The Bolivian packaging industry is supplied entirely with raw materials that come from Europe, the U.S. and neighbouring countries. Only in the case of wood for crates and boxes does any packaging material originate in Bolivia. The implications of this lack of self-sufficiency in any packaging area are substantial. For example, the prices of certain materials is so high that sometimes the finished product's quality has to be sacrificed in order to lower cost; otherwise the product cannot be sold.

A classification based on types of raw materials used to manufacture packages for the food and beverage industries follows:

Material: Plastics
Products: Bags, bottles, pails, films

Material: Glass
Products: Bottles, flasks

Material: Metal
Products: Cans, large containers

Material: Paper and carton
Products: Corrugated and non-corrugated cartons for boxes; Kraft paper bags

Material: Wood
Products: Boxes, crates, pallets

Material: Textiles
Products: Bags (large and small)

There are no standards or regulations for packaging materials used in contact with foods and beverages (in Bolivia).

Names of manufacturing firms, prices quoted (when available) and pertinent comments have been compiled according to the aforementioned classification.

PLASTICS: There are several plants that make different plastic products for the food industry. Others manufacture toys, flasks, insulating panels, etc. This is probably the most diversified and developed industry in the country. Several plants use three different methods to manufacture plastic products: extrusion, blowing and injection. Other methods used are rotomolding, expanding or weaving. No one fabricates laminated materials.

The plastic materials most commonly used are high density (HD) and low density (LD) polyethylene (PE), polypropylene (PP), and polyvynilchloride (PVC). Other materials employed are polycarbonates and polystyrene. Since the extrusion process is relatively simple, it has brought into being many clandestine plants which operate illegally. They are not registered in any local, regional or national governmental office.

Price of plastic raw materials used for fabricating different products fluctuates between US$ 2.15 and US$ 5.00 per Kilogram.

The name and location of several plants are as follows:

Cochabamba: INDESA, PLASTOFORM, and INDUSTRIA ESTRELLA

Santa Cruz: PABOA, PLASTICOS ORIENTAL, and ENVACRUZ

La Paz: SOL-PLAST, PLASTIPLAS, and PLASFILM

One of the plants visited in Cochamamba was:

INDESA
Casilla 2947
Cochabamba, Bolivia
Miguel Peiser - General Manager

A product made at INDESA for packaging dry milk is white polyethylene bags. The plastic material is manufactured in West Germany by BASF. According to Mr. Peiser, the latter material is 100% free of any toxic substances. INDESA has the equipment to manufacture low density polyethylene bags and also corrugated carton boxes. These two items might be combined to form a bag-in-box. Estimates provided by the factory manager place the cost of such a bag-in-box system, capable of handling approximately 30Kg. of pulp or other liquid per box (35 litre bag of 100-150 micron atoxic plastic polyethylene film with a 20 x 8 x 16" corrugated box of 30030 carton) at approximately US$1.16 (or $0.04/Kg.). Prices are for minimum orders of 1,000 units and printing on bags or boxes would increase the price (2 to 3%), except when purchasing 5,000 or more units at one time, in which case the extra cost is absorbed by INDESA.

Although this dual package is not very expensive, it presents problems for non-refrigerated transport because the polyethylene liner cannot provide an aseptic environment for the contents. Aseptic packaging will be covered in more detail later in this report. The INDESA bag-in-box system might also have other applications such as for shipping dry spices and glazed fruits.

The name and address of another plant that makes plastic products is shown below:

Although this dual package is not very expensive, it presents problems for non-refrigerated transport because the polyethylene liner cannot provide an aseptic environment for the contents. Aseptic packaging will be covered in more detail later in this report. The INDESA bag-in-box system might also have other applications such as for shipping dry spices and glazed fruits.

The name and address of another plant that makes plastic products is shown below:

ROTAPLAST, LTDA
Av. Blanco Galindo, Km 4.8
Cochabamba, Bolivia
Ing. Hans Elsner - General Manager

This company manufactures large cylindrical containers by the rotomolding process. Prices quoted varied from US$ 5.90 per 20-litre container to US$ 48.82 per 200-litre container. This firm also manufactures plastic products by blowing, injection or thermoforming methods. PLASTOFORM LTDA, which is located in La Paz, is also owned by the same company.

METAL: A commercial firm that fabricates cylindrical and rectangular (cross section) cans is:

FABRICA BOLIVIANA DE ENVASES (FABE)
Cruce Taquina - Zona Tiquipaya
Cochabamba, Bolivia
Ing. Arturo Echevarria - Plant Manager
Lic. Manuel Alfaro - Administrative and Financial Manager

FABE has four assembling lines for metal cans. The raw material (tinplate or tin-free steel) comes from Japan and is delivered in sheets or coils. Cans are made from either type of metal. An enamel coat is applied to the cans' interior and exterior. The composition of the enamel used inside the cans varies according to the product to be contained.

The FABE plant is also equipped to fabricate can ends (regular or easy-open type) and to lithograph directly on containers. Cans are used for processing fruits and vegetable products, meats and other foods. They are also used for carbonated soft drinks, beer, evaporated or condensed milk, paints, vegetable oil, lubricants, seeds, products in powder form, etc.

Prices vary according to can size, configuration, product to be contained, quantity ordered, etc. A few quotations follow:

TYPE OF CAN	CAPACITY	PRICE/1,000
Cylindrical	16 ounces	US$ 450
Cylindrical	500 grams	US$ 350
Cylindrical	5 litres	US$ 1,100
Rectangular	2 litres	US$ 900
Rectangular	18 litres	US$ 3,500

There are two other companies that also make paper and carton products: one is INDESA and the other is KUPEL. They are located as follows:

INDESA
Casilla 2947
Cochabamba, Bolivia

KUPEL (Industria Crucena de Papel, Ltda.)
Casilla 2865
Santa Cruz, Bolivia

WOOD: Only one firm named CARPINTERIA JACARANDA fabricates wooden boxes for agroindustrial applications on a commercial basis, although there are numerous artesanal manufacturers fabricating crates for such uses as tomato transport in the Valles Altos. Jacaranda's address is the following:

CARPINTERIA JACARANDA
Av. Blanco Galindo, Km 7
Cochabamba, Bolivia

Other wooden products are crates and pallets. The government should provide concessionary lending to promote private sector development of a box factory capable of producing large quantities of boxes per year. The boxes have multiple applications. One of them is for transporting produce in order to reduce post-harvest losses.

TEXTILES: There are three factories that manufacture textile bags for the sugar industry. All of them are in Santa Cruz (INDUSTRISA TEXTIL GRIGOTA, TEXTILES ORIENTALES, and TELARES SANTA CRUZ). Name and address of one of these firms is:

INDUSTRIA TEXTIL GRIGOTA
Casilla No. 3100
Santa Cruz, Bolivia

6.2 Adoption of New Technologies

The technology used by some packaging plants in Bolivia is relatively new or has been updated by introducing appropriate changes. In some cases, for example that of the SEASA plant in Cochabamba, the technologies are apparently completely current with developments in the industrialized world. Nevertheless, the range of available technologies is extremely limited, and in most cases only the most widely proven packaging processes have been adopted.

For example, none of the plants that manufacture plastic products are equipped to make laminated bags for aseptic bulk filling of liquids, principally liquids with solid or semi-solid particles such as tomato sauce and paste. These bags, when needed, would have to be imported from Europe, the U.S., Israel or Japan.

Except in the case of the SEASA ready-to-drink containers (250 and 1,000 ml. - see Section 5), aseptic packaging technologies are not in use in Bolivia. Their key advantage is that perishable products can be transported without refrigeration - potentially a major benefit in Bolivia which has no established cold chain (see Section 7). The key disadvantage of aseptic packaging methods is cost, both of the bags and of the filling machinery. Discussions held in Bolivia with representatives of Alfa-Laval, one of the major suppliers of aseptic equipment in the world, revealed that aseptic bags purchased from Chile would cost approximately US$8-10 (200 litre size) or $4-5 (50 litre size). In addition, these bags would have to be placed in some form of support structure - Chilean prices run at approximately $12 for a 200Kg. drum. This suggests that the product to be packaged must be able to support a packaging materials cost alone (i.e. excluding depreciation of filling equipment) of approximately US$0.20/Kg., although other, cheaper sources of packaging material may be available.

Even if the price of the packaging material can be supported, however, there is also the cost of the pasteurization and filling unit. Alfa-Laval's minimum sized unit operates from 2-3 tons per hour up to 8 tons per hour and is designed to fill the 200Kg. bags. This unit would cost approximately US$200,000 CIF Bolivia, without the steam generation unit (suggested by Alfa-Laval as available from the U.S.A. at US$6,500 FOB or $10,000 CIF Cochabamba). This equipment is described briefly in the attached sheets in the Appendix to this Chapter. Another manufacturer of aseptic bags and equipment is Liqui-Box of Israel. This company has had discussions with Del Valle concerning the supply of aseptic equipment. Brief details of their bags are also included in the Appendix.

In general, aseptic bags are manufactured from a variety of laminates compatible with the product and required to extend its shelf-life. Such laminates include the following flexible materials: ethylene-vinyl-acetate (EVA), copolimers, aluminum foil, etc. Each bag is provided with a spout and cap designed for aseptic filling. The mechanical properties of multilayered bags (used for thermoprocessing foods) are improved when irradiated. The key features of aseptic bags are as follows: strong, durable, presterilized, microbiologically safe and a unique gas-tight spout. Technical specifications of laminated aseptic bags and materials (including spout and cap) must comply with FDA (USA) specifications and regulations.

Aseptic bags are fabricated for different purposes with different dimensions, etc. Data tabulated below (based upon Liqui-Box's supplied dimensions) may be used as an example:

CAPACITY	DIMENSION	TYPE/PURPOSE
55 gallon	149 x 100 cm	Narrow Neck
55 gallon	149 x 100 cm	Medium Neck
55 gallon	145 x 125 cm	Wide Neck
6 gallon	63 x 54 cm	--------
2 litre	30 x 28 cm	For samples

All bags are supposed to be supported when filled by an outer container, for instance a barrel or heavy-duty cardboard box. Price of bags or supporting containers change according to the following considerations: intended use, size (dimensions), quantity purchased, etc.

6.3 Storage Facilities and Availability

Warehouses for storing raw materials and finished products (cans, bottles, bags, boxes, etc.) are available at the manufacturer's location. However, a majority of the food plants lack adequate storage facilities. In many instances, space capable of being utilized is missing due to the cramped conditions of the manufacturing process. Controlled temperature storage is almost completely absent except for ice-cream and ice manufacturers which possess reasonably extensive freezer space (e.g. Gelato and Panda).

Commercial refrigerated storage for keeping food products is completely absent. The same situation is faced with regard to frozen storage facilities. The use of ice to retard spoilage and extend shelf-life of fresh commodities (fruits, meat, poultry and vegetable products) is not a common practice at most retail stores or in open-air markets. There are no temperature controlled storage facilities available at any of the nations airports, and even ambient storage space is severely limited. ENFER, the state railway network, does possess reasonably extensive marshalling yard storage space, but it too is only available at ambient temperature.

The only other refrigerated storage space identified in Cochabamba included three 3 x 3 x 15 metre reefer style containers at the San Benito experimental station between Cochabamba and the Valles Altos, and 2 actual portable reefer units of 3 x 3 x 6 owned by ASOBOFLOR in Cochabamba itself.

The San Benito units are made by DISERENS in France and are approximately 10 years old. They are equipped with humidifiers but these are in need of servicing. They can maintain a temperature of between 0-20°C. They are used relatively little at the moment, none of them being at low temperature when the AMIS team visited, although the team was assured that all are functional. They have recently been used for storing peaches. The units could be made available for IBTA approved storage by outside groups.

ASOBOFLOR, the cut-flower exporting group in Cochabamba, makes more extensive use of its units. The two current units are to be moved in the near future. One unit will be moved to Santa Cruz airport where it will be used for transfer cooling of flowers dispatched from Cochabamba to Miami (incoming flights arrive early afternoon, while outgoing flights do not depart until after midnight, leaving a 10 hour or more wait for the flowers). The other unit is to be transferred to Punata, on the edge of the lower section of the Valles Altos, where current cut-

flower production is focused. The units will be replaced in Cochabamba by two purpose built chill-storage chambers of 7 x 7 metres each at a quoted cost of US$20,000 apiece (local construction).

ASOBOFLOR has also purchased two refrigerated trucks - one used unit from Brazil and one fabricated locally. The new unit is based upon a Volkswagen chassis coupled to an insulated, Carrier cooled body of 1.2 x 1.2 x 4 metres and was fabricated by BOPAR, a local body shop for a total cost (including chassis) of US$40,000. This is considerably below the cost of importing a ready-made unit from the United States.

6.4 Conclusions and Recommendations

The key constraint faced by Bolivian packaging manufacturers is high production cost. This is caused by several different factors:

1. The high price of imported raw materials.
2. High import duties, which worsen price structure
3. Limited product demand that causes packaging plants to run below full capacity and restricts economies of scale

Another serious problem is contraband, which affects the entire packaging industry and particularly the companies that make plastic bags. Products smuggled from neighbouring countries are sold at very low prices that local producers cannot meet.

It is clear from the cost structure in Bolivian that the production of output in retail size packaging for export is generally not feasible. Even bulk packaging has a number of constraints attached to it. Economical bulk packaging is only readily available for either non-perishable products (e.g. spices) or for perishable products where a cold chain can be established and maintained (see Section 7.3). Nevertheless, within the limits set by these provisos, bulk packaging can be obtained at a very moderate cost (as low as US$0.04/Kg.).

Where cold chains prove difficult or too expensive to maintain, the only option may rest with the use of bulk aseptic packaging. This system has a number of advantages, including transport cost and the desirability of the product. The cost of the pasteurizing/filling equipment, however, means that such a system would appear possible only for fairly major processing operations (in excess of 3 tons/hr.). Even where such volumes could be assured, the cost of bags is a major constraint to aseptic packaging methods. It may, of course, be possible to establish domestic manufacture of aseptic bags (but only where major orders could be guaranteed to the packaging firm) or, alternatively, identify a cheaper supplier of bags.

While there are probably fewer artesanal packaging operations than there are artesanal processors, it is nevertheless true that the majority of packaging companies are small-scale enterprises with limited access to funding or technological information. The improvement of packaging operations will therefore depend to a considerable extent upon the availability of technology transfer programs and similar opportunities, much as has been proposed for processing companies.

The lack of available commercial storage space also constitutes a constraint to the development of an efficient agroindustrial marketing system. While limited space does exist within manufacturing plants themselves, as well as in such facilities as the railways and some transportation companies, this space is generally inadequate to current or, particularly, future needs, and is, in any

case, ambient storage only. Refrigerated storage (beyond that owned by ice-cream and ice manufacturers) is restricted to only two sites (San Benito and ASOBOFLOR). Even in these cases, the space is extremely limited and of only limited availability to outside users.

It is quite clear that the decision to support the development of increased production and marketing of any perishable category of goods (including fruit pulps or juices, tomato pastes or even fresh produce) will almost certainly require public access to controlled temperature storage facilities - particularly at shipment points such as airports, railways and truck yards. In some cases it may be possible to avoid the use of these facilities through the employment of aseptic packaging techniques. Aseptic packaging, however, appears suitable only for large volume outputs of relatively high value products. Simple pulps and pastes may not be able to support the costs of the specialist laminated bags required by aseptic packaging lines.

Once the line of probable products for market development have been determined (based upon outputs II and III of this project), close attention should be given to the resulting needs for storage facilities.

APPENDIX FOR CHAPTER 6

ASEPTIC PACKAGING TECHNOLOGIES

FIRANTEX
REPRESENTACIONES

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Gerente General

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Casilla 3181

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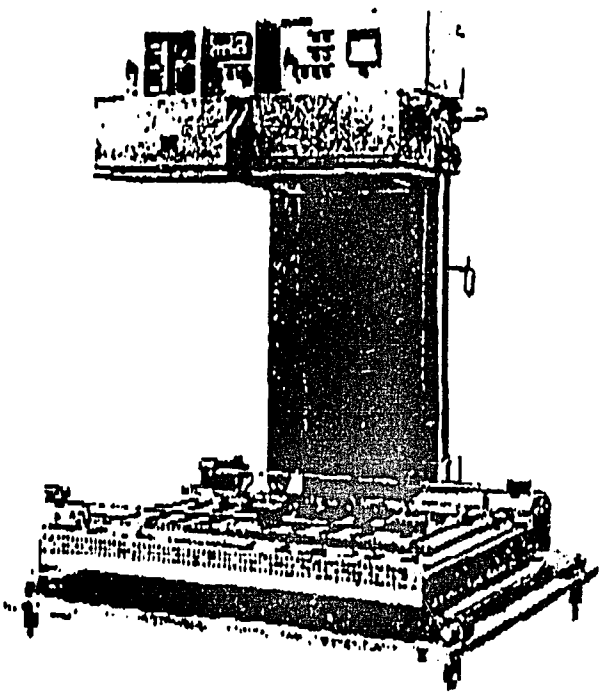
StarAsept

Aseptic bulk filling machine

Application

Filling of bulk-size packages with liquids of high as well as low acidity, under aseptic conditions. High-acid liquids may even contain solid or semi-solid particles. The filler is designed for CIP.



Working Principle

Package. The packages are manufactured from a variety of laminates to match the product and required shelf-life. The packages are provided with patented spouts designed for aseptic filling. The inside of the packages is sterilized before delivery; the packages are supplied flat and contain no air or gas. They are available in volumes from catering size up to sizes intended for shipping of product from manufacturer/grower to processor/packer/distributor. All packages are intended to be supported, when filled, by an outer container, for instance a barrel or heavy-duty cardboard box.

Filler. The main sections are:
Roller conveyor on hydraulic lifting table
Filling head with package manipulation and filling devices
Control and operator panels
Service units including electrical gear, steam and pneumatic valves, lifting table hydraulics, etc
Machine frame

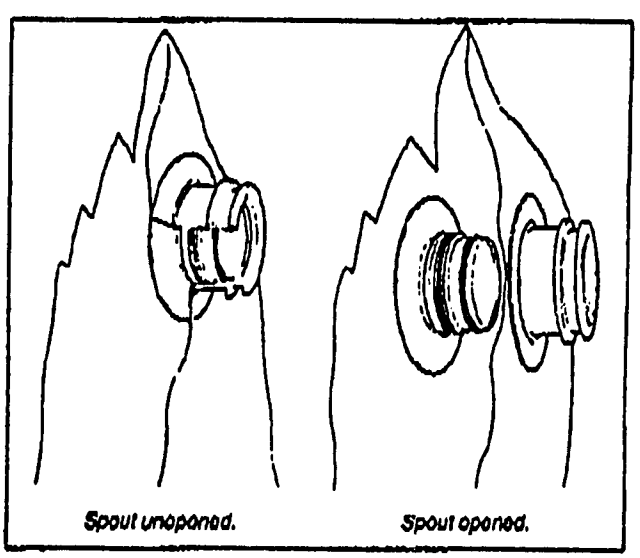
The filler is normally installed together with barrel (or box) feed and discharge conveyors. In front of the filler, an operator's bridge should be placed (bridge and ancillary conveyors are not included in the standard aseptic bulk packaging system equipment).

Filling cycle. The filling cycle is divided into a manual preparatory part and an automatic filling part:

Manual preparation
1 The operator takes a flat and sterile package from its wrapping and places it inside a barrel arriving on the feed conveyor (most common production set-up for large packages). The operator pushes a button to start the conveyors and initiate the filling cycle. A barrel moves into position underneath the filling head. The lifting table ascends to prefilling level, and the spout bung gripper moves to engage the bung.

2 The package now in filling position, the operator pushes a pair (for safety) of buttons. The still unopened spout is brought to the filling valve.

Automatic filling
3 The spout is pressed tightly against the filling valve outlet.
4 Steam is admitted to the filling valve chamber, sterilizing it and the spout including its exposed bung face. Air and condensate are expelled.
5 Sterilization takes place at setpoint temperature and time, monitored by the fail-safe control system of the filler.
6 After sterilization, the filling valve opens and simultaneously



8 The filling valve closes, and steam enters the filling valve chamber, forcing remaining product into the package. Steam then enters and inflates the top of the package.
9 The inflated package triggers a sensor, causing the spout to be closed while still in a sterile environment.

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Aseptic bulk filling machine

Operation. The lifting table is hydraulic, and the package manipulation devices are operated by pneumatic cylinders. The steam and filling valves are pneumatic and solenoid operated.

Control system. The control system features an Alen 05 microcomputer process control unit. The package positions on the conveyors are marshalled by photocells and the lifting table levels by proximity switches. Prefilling is time-controlled, and main filling and topping-up are weight-controlled by means of load cells. Sterilization is safe-guarded by a timer and temperature monitor, and both are recorded on a chart. Should the temperature drop below setpoint, the sterilization procedure is automatically restarted from the beginning.

Sampling. Facilities are provided to draw small samples of product in the course of production.

Cleaning. The filler is designed for CIP. During cleaning, a dummy spout is placed in the filling valve outlet. Cleaning in line with the sterilizer. Recommended flow rate 12 000 l/h.

Capacity. The capacity depends on package volume, product characteristics, product supply facilities and pressure, and operator dexterity. A twin filler installation more than doubles the capacity and improves utilization of the operator's time by allowing him to prepare and sterilize one package while the other one is being filled; initial and concluding filling (when flow rate is reduced) of the two packages can also overlap.

Basic unit

Standard equipment. The filler is a self-contained unit, ready to be sited and connected to electric, pneumatic, and steam services and the product supply line, and the feed and discharge conveyors. The latter are not included; nor is the operator's bridge.

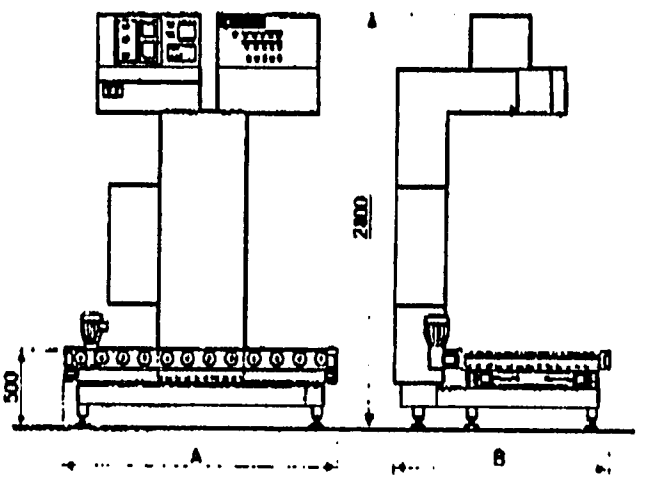
Material. All parts in contact with product as well as the upper framework, panels, and spout mechanism are of stainless steel. The lower framework, lifting table, and roller conveyor are of galvanized mild steel.

Versions. Single filler with 920 mm or 1300 mm wide lifting table and roller conveyor. Twin filler consisting of two identical single fillers.

Optional Equipment

- Voltage stabilizer
- Filter for culinary steam:
  Alt. 1. Steam separator, steam trap
  Alt. 2. Steam separator, steam filter, steam trap
- Lower framework, lifting table, and roller conveyor made of stainless steel instead of mild steel
- Band conveyor for handling smaller bags into cartons
- Operator's bridge

Dimensions



Conveyor width, mm	A mm	B mm
920	2180	1760
1300	2180	2090

Technical Data

Steam supply. 400 kPa (4 bar); culinary quality steam recommended, max. 20 kg/h

Compressed air. 600 kPa (6 bar), 20 Nl per package

Electric power. 220/380 V 50 Hz 3-phase or 220V 50 Hz 1-phase AC (other voltages on request), 5 kW

Product supply. 50–200 kPa (0.5–2.0 bar) depending on product viscosity

Connections. Inlet and outlet 51 mm (2 in), SMS union

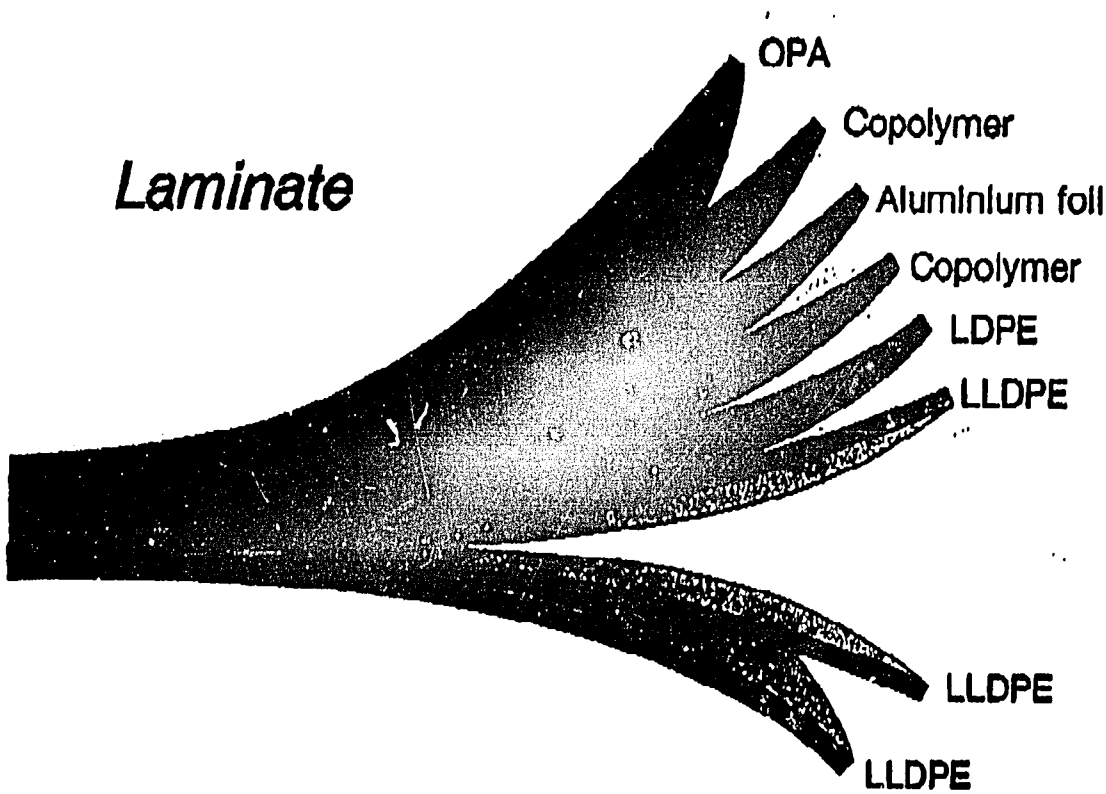
Shipping Data

	920 mm conveyor	*1300 mm conveyor*
Net weight	1500 kg	1730 kg
Gross weight	6200 kg	6450 kg
Volume	15.3 m^3	17.8 m^3

StarAsept

69c

StarAsept Super Barrier Bag (Transofoil)



Key features – unique gas-tight spout
– strong, durable, and bacteriologically safe
– presterilized

69d

Technical specifications

Laminate

	Unit	Measuring condition	Test method	Typical value
Film thickness	micron		Microscopy	80
Oxygen transmission rate	cm^3/m^2, 24 hrs atm	23°C, 50% RH	ASTM D 3985	0.02
		40°C, 50% RH		0
Water vapour transmission rate	g/m^2, 24 hrs	38°C, 90% RH	Electrolytic (TNO/PIRA)	0
Ultimate tensile strength	kN/m	23°C, 50% RH	ASTM D 882	
MD				3.9
TD				4.1
Ultimate elongation	%	23°C, 50% RH	ASTM D 882	
MD				82
TD				75
Sealing strength	kN/m	23°C, 50% RH	ASTM D 882	4
Optical density			ANS *) PH2 19-1976	3.9
Light transmission	%			0.01

*) American National Standards

Spouts

Dimensions:			
	height	28 mm	20 mm
	inlet diameter	49 mm	30 mm
	max outer diameter	63 mm	50 mm

	Unit SI	Value	Test methods DIN	ASTM	ISO	DSM
Density	kg/m^3	963	53479	D1505	R1183 meth. D	
Melt flow index (I_2)	dg/min	8	53735	D1238	R 292	
Spiral flow test	mm	240	—	—	—	*)
Modulus of elasticity	N/mm^2	1700	—	D 790	—	
Izod, notch 0.07"						
at + 23°C	kJ/m^2	34	—	D 256	R 180	
at −20°C	kJ/m^2	34	—	D 256	R 180	
ESCR (at 23°C and 7 N/mm^2)	h	22	—	—	—	**)
Tensile strength	N/mm^2	31	53455	D 638	R 527	type 2
Elongation on breaking	%	500	53455	D 638	R 527	type 2
Shore hardness D	—	69	53505	D1706	R 868	
Vicat softening point - VST/A	°C	127	53460	D1525	R 306	
Melting point	°C	135	—	—	—	***)

*) Section = 10 × 1.6 mm
melt temperature = 240°C
mould temperature = 50°C
injection pressure (polymer pressure) = 92 N/mm^2

**) DSM method

***) T (test DSC) = 20°C/min

Starsept

69e

LIQUI-BOX ISRAEL BAG IN BOX PACKAGING SYSTEM

LICENSEE OF : LIQUI-BOX CORPORATION

ASEPTIC BAGS - TECHNICAL DATA

Dimensions

55 Gallon	149 x 100 cm	Narrow
" "	149 x 110 cm	Medium
" "	145 x 121 cm	Wide
6 Gallon	63 x 54 cm	
2 Litre	30 x 28 cm	for samples

Composition

The bags are made from a Metalized Polyester with an EVA liner.
The composition of the laminate from the outside - inside is :-
EVA Copolymer 50 microns
Metal (AL)
Polyester 12 microns
EVA Copolymer 50 Microns
Hot lamination ensures solvent free laminate.
In addition to the Laminate there is an internal liner, also made from EVA either 50 or 100 microns according to bag's volume.
The metalization on the polyester is always outside in order to protect the bag's contents from contamination by Aluminium.
The bag will withstand a temperature of -20 Degrees C.
The Spout & Cap are suitable for most Filling Machines.
All materials including the spout and cap are approved by the F.D.A. (U.S.A.) Title 21 CFR Sections 1520, 1350.

Note The constitution of this bag makes it suitable for the filling and delivery of concentrates and viscous liquids. If you intend to use these bags for the delivery of citrus juice, tomato juice, wine, etc. please make a special order so that we can sup bags suited to the purpose.

.....2/

12 KEHILAT VENEZIA ST. TEL-AVIV 69010, ISRAEL. P.O BOX 24149, TEL AVIV 61240. TEL: 03-490707, 490703-4. TELEX: 40837.

A SUBSIDIARY OF : CARMEL-PLARO CONTAINERS LTD • L.P.N. ARAN KIBBUTZ NACHSHON • C.L.P. KIBBUTZ NEGBA, SDE-YOAV.

Made in Israel

Oxygen Permeation

The oxygen penetration of the laminate is smaller than

$$0.765 \frac{cc}{1sq.m\text{-}24\ hours}$$ according to test ASTM D 3985.

The oxygen penetration of the spout and cap is smaller than

$$0.16 \frac{cc}{24\ hours}$$

Radiation

All bags are radiated by Gamma Radiation of 2.5 megarad. There is one radiation indicator on the carton and one on the top bag inside the carton. Customers may request additional marking.

Permitted Deviations

Thickness of material: Plus/Minus 10%
Spout Location : " " 5 mm.

Quality Control

1. The sealing is tested by air inflation in special equipment which enables equal pressure to be applied to all sealings. Burst pressure has to reach our standard according to type of bag.
Frequency of testing: Once per hour.
2. Spout sealing is tested by pushing the spout from the laminate. Pressure and time are controlled.
Frequency of testing: Once per hour.
3. Tensile testing of bag's sealing - minimum 4,000 gr/inch.
4. Constant visual checking by Quality Controller.
5. We co-operate with the Microbiological Institute, Haifa for all microbial aspects of the bags.

In the interests of further development we reserve the right to alter specifications.

****

12, KEHILAT VENEZIA ST. TEL-AVIV 69010. ISRAEL. P.O.BOX 24149, TEL AVIV 61240. TEL: 03-490707, 490703-4. TELEX: 40037.

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7.0 INFRASTRUCTURE AND TRANSPORT

The availability of adequate infrastructure and transport can be crucial to the effective functioning of any marketing system, particularly in a land-locked country such as Bolivia. The availability of power and water are obviously fundamental to the operation of most industrial processes, including those in agroindustry. Adequate communications are also essential. Even for domestic marketing systems, the ability of producers, processors and traders to exchange information on price and availability is important for market efficiency. For export systems this need is intensified as requirements for functioning telex or facsimile services and similar international communications channels are added.

Transport plays a crucial role through its effect in determining such factors as the loss rate for post-harvest collection, the cost of product delivery (national or export) and the form in which the product can be shipped (ambient, chilled, frozen), as well as the feasibility of handling limited life span products (transport times from producer to consumer, availability of air connections etc.)

In the sub-sections below these aspects are discussed in more detail. It should be noted that, as of March 1990, the Boliviano (Bs.) was valued at US$0.326. The quintal (QQ.), a common measure in Bolivia, is usually equivalent to 45Kg.

7.1 Power, Water and Communications

Both Cochabamba and Santa Cruz, the two major regional cities and capitals of their respective Departments, are modern fully equipped urban areas. Cochabamba, centrally located for both the Chapare and the Valles Altos, possesses a population of approximately 350,000 inhabitants and covers an area of approximately 30Km^2.

Bolivia is a major producer of natural gas and gas is widely used as a domestic energy source, but the lack of a pipeline supply (most is used in bottled form) restricts its applicability for industry. Most industrial and commercial operations therefore either generate their own power or utilize the municipal electrical system. The Cochabamba supply, generated by the National Electrical Company (ENDE), totalled nearly one quarter of a million MWH in 1988, of which 33% was consumed by industry. Nevertheless, electrical costs seem very high; tariffs for commercial use for 1989 quoted by the Chamber of Industry (Cochabamba Chamber of Industry, 1989;p.16) are approximately US$1/KWH.

Potable water supply for Cochabamba is well developed but suffering from the repeated below average rainfall years suffered by the region recently. No water cutoffs have occurred recently, but the supply is extremely limited at present. A new Municipal water development project is underway (the Misicuni project) and it is hoped that the situation will largely be resolved within three years.

Cochabamba possesses full telecommunications facilities, including facsimile and telex, both nationally and internationally. Station to station calls to North America cost approximately US$1.75/minute in 1988, while telex charges cost approximately the same on automatic devices. Direct dialling systems are available.

An industrial park of 436 Has. has been developed in Santivanez, some 40 minutes from Cochabamba in the direction of the Valles Altos. Land is available in the park at a cost of US$16.80/sq.metre.

7.2 Local Transport

It is assumed that local transport will consist primarily in the delivery of agricultural produce from growers to the plant location. This task can be in turn broken down into two components; delivery from the farm to the roadside and from roadside to Cochabamba or other plant location.

Little detail can be provided concerning farm/roadside delivery. Generally the responsibility of the farmer himself, this delivery may be by human headload, donkey, canoe or other means. The cost, difficulty and losses associated with this stage obviously depend upon the distance of the farm from the main road and the care taken in produce transport.

In both the Chapare and Valles Altos, a single principal route traverses the region and it is along these routes that principal local transport services are available.

The Chapare road, connecting Cochabamba with Santa Cruz over a distance of 460Km., is generally in good condition with most of the distance paved within the last few years. There are, however, sections at the entrance to the Chapare (from Cochabamba) and between Cochabamba and Santa Cruz that are still unpaved (see Diagram 7.1). A major project is due to commence shortly to fill in these two stretches. Most agricultural areas of the Chapare are close to, or connected with, this road.

Road access to the Valles Altos has been much poorer in the past, discouraging transport operators and leading to high rates of post-harvest loss. Until a year ago the only route to any of the three key centres in the Valles Altos (Mizque, Aiquile and Omereque) was through Totora to Aiquile, a journey of 5 or more hours through extremely dusty, poor roads. From Aiquile to Mizque and Omereque required further journeys of several hours to Aiquile and up to 15 hours to Omereque (depending upon the season).

A USAID funded project has now re-opened the old route from Cochabamba directly to Mizque, and on to Aiquile (see Diagram 7.1). Journey times have been cut to 3.5 and 4.5 hours respectively and the new road, while not paved, is much improved in terms of level of damage to vehicles. An improved connection to Omereque is planned.

A railway line theoretically operates from Aiquile through Mizque to Cochabamba. During the 1989-90 rainy season, however, the system did not operate for 4 months, and even when it is operating, takes anywhere from 8-23 hours to make the relatively short journey (Paulsen, 1990;p.5).

In both regions, local transport systems are operated without any reference to the specific needs of delicate or perishable cargoes. Produce tends to be loaded loose within the trucks (generally in the 8-20MT range) and loss rates are high (see Section 2.4).

As is typical for data relating to the Chapare and Valles Altos, considerable discrepancies exist between estimates provided by different sources in relation to transport. Not only are there

significant differences in costs, but also in distances. Some of these differences may be explained by the selection of different routes (e.g. routes to Mizque before and after the opening of the direct route). Transport costs and distances are summarized in Table 7.1 below.

The figures given by Navia (1990) for transport costs from the Valles Altos are almost certainly too low. Not only are they contradicted by other PDAC data (PDAC Map refers to a map of the Valles Altos distributed by PDAC with inserted tables of data, including transport costs and distances), but they also conflict with responses to the field team, which ranged from approximately Bs.3/QQ (when entire vehicle rented) to Bs.5/QQ (loose loads). Accompanied transport in buses is quoted by Paulsen at Bs.2.5/QQ but is obviously unsuitable for all but small traders.

In general, therefore, local transport costs are likely to fall in the range of Bs.3-6 for the Valles Altos and Bs.2-3 for the Chapare (USc 0.225-0.45/Kg. and c0.15-0.225/Kg. respectively). To these figures should probably be added an allowance for tolls - calculated by Paulsen (1990;p.3) at approximately Bs.1.2/QQ for the Valles Altos-Cochabamba route

It should also be noted that there are indications that local transporters are flexible in their attitude to transport costs and conditions and could be persuaded to modify procedures should earnings justify it. In a study undertaken by Paulsen (1990) of the impact of opening up the new Cochabamba-Mizque-Aiquile road, she notes that transport costs have dropped significantly, at least for passengers (fares declined from Bs.13-Bs.6/person), with some indications that freight rates would follow. She also noted that passenger vehicle capacity increased 30% within 3 months of completion and opening of the road.

While the response in terms of passengers has definitely been stronger than for freight, it is possible to argue that limited freight traffic (due to continuing drought conditions etc.) have held back response in this area. Should freight traffic start to increase it is likely that more trucks would also enter the competition.

Map 7.1: Local Transportation Map

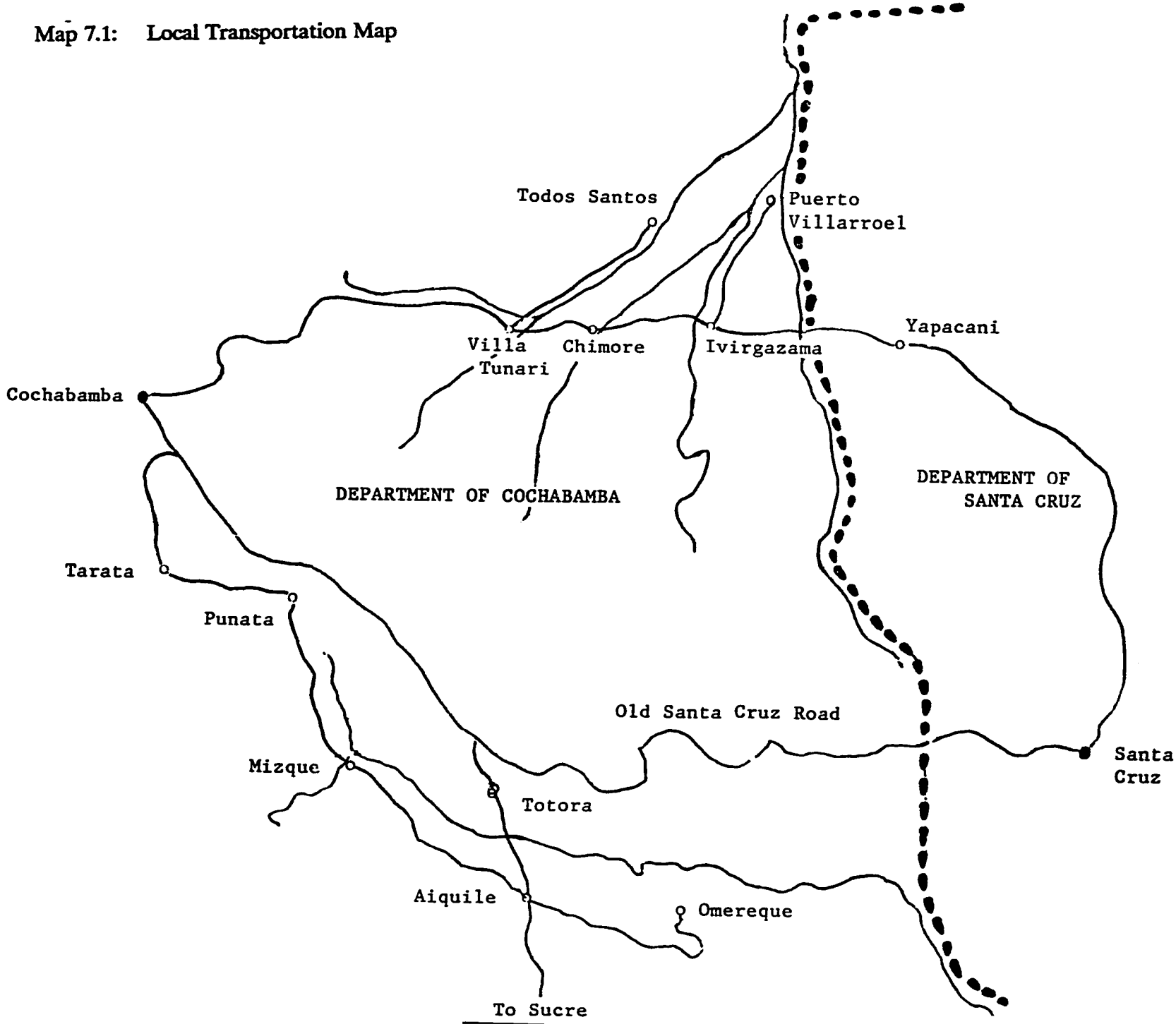
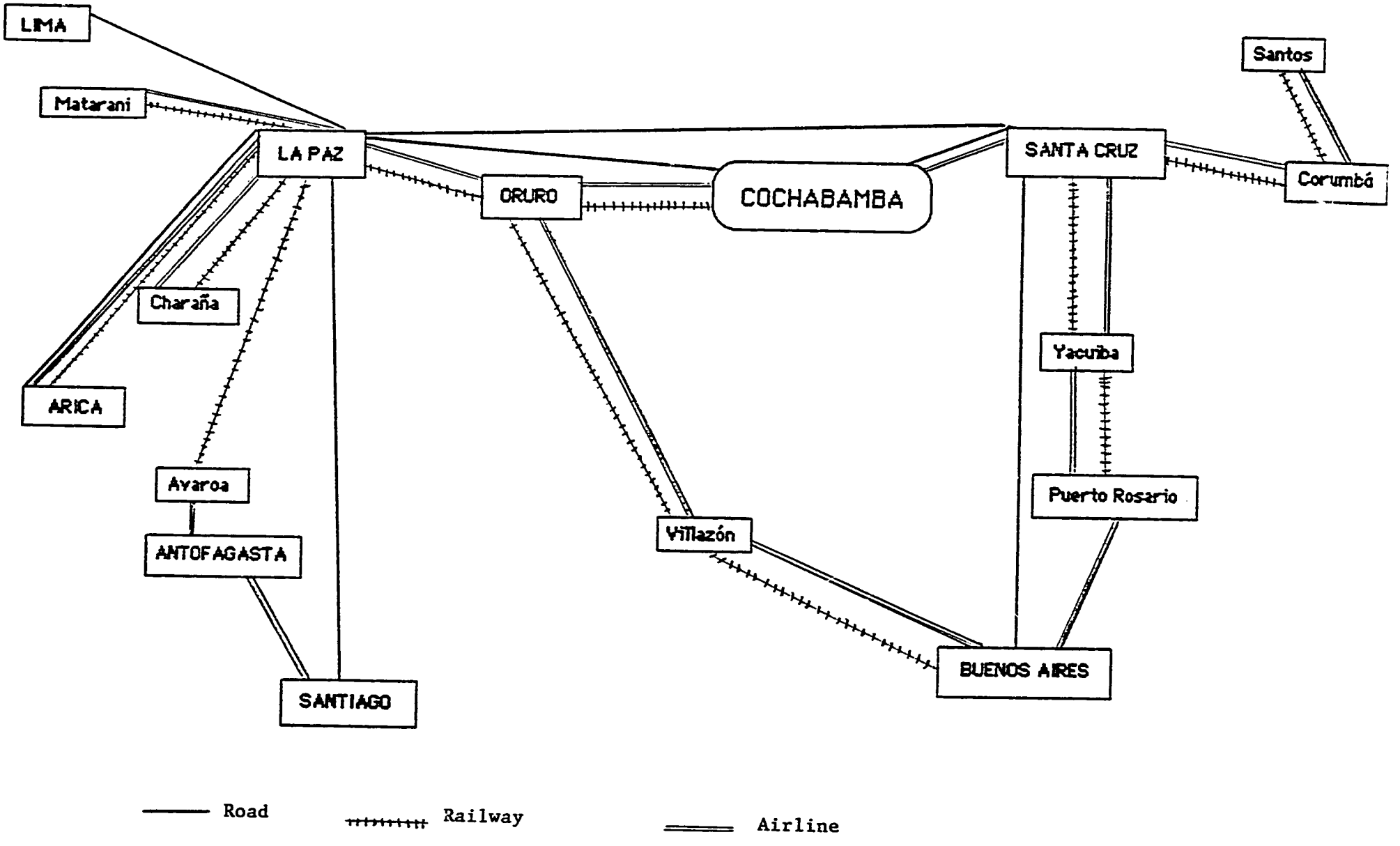


TABLE 7.1: LOCAL TRANSPORT COSTS

ROUTE	SOURCE	DISTANCE (Km)	COST (Bs./QQ)
Mizque-Cochabamba	Navia, 1990	256	1.5
	PDAC Map	156	4
	Collected Data	-	3-5
Aiquile-Cochabamba	Navia, 1990	214	1.5
	PDAC Map	222	5-7
Omereque-Cochabamba	MVA, 1990	156	1.5
	PDAC Map	215	5-7
	Estimated	285	-
Villa Tunari-Cochabamba	Navia, 1990	160	2
	MACA Estimates	-	2.45
Puerto Villarroel -Cochabamba	Navia, 1990	246	2.3
Villa Tunari -Santa Cruz	Navia, 1990	300	2
	MACA Estimates	-	2.8
Puerto Villarroel -Santa Cruz	Navia, 1990	240	1.8

Map 7.2: National and International Transport Routes



7.3 International Transport

While road transport offers the only realistic option for local transport, other methods of transport are available for international routes. These include rail, air, sea and even, in some cases, river transport. As the schematic in Diagram 7.2 shows, Cochabamba is not directly connected into international transport routes and outgoing cargo must generally pass through La Paz or Santa Cruz before leaving the country. The cost, availability and suitability of different transport mechanisms is discussed below.

7.3.1 Road Transport

Road transport obviously offers greater flexibility than any other method and adequate road links connect Bolivia with the neighbouring countries of Peru, Chile, Argentina and Brazil. Even more importantly, good road links connect Cochabamba with the principal maritime export ports of Africa and Iquique in Chile and Matarani in Peru.

The associated MVA Transport report (see Annex III) lists 21 Bolivian companies involved in road haulage in La Paz alone, although omits to survey firms in Cochabamba and La Paz. Typical equipment for these firms is 20-40MT articulated trucks providing a selection of flatbed, chassis (for containers) or enclosed bodies.

As for a number of other areas of data in Bolivia, frequent contradictions exist between estimates derived from different sources. The MVA study, for example, quotes road freight costs to Africa at US$75/MT ($80/MT for the return journey), while another study, prepared in January 1990 by SUBDESAL, quotes rates for this same route at $50/MT. Disagreements also exist with respect to distances and times.

The answer probably lies in the negotiated nature of many haulage charges and suggests that careful bargaining, combined with regular, full-truck loads, may result in substantial differences in freight haulage costs.

TABLE 7.2 ROAD TRANSPORT ROUTES, JOURNEY TIMES, DISTANCES AND COST

JOURNEY	DISTANCE (KM)	TIME (HRS)	COST (US$/TM)
Cbba-Santa Cruz	410	8	19.40
Cbba-La Paz	371	8	14.36
Cbba-Matarani (Peru-Port)	1140	72-96	60.00
Cbba-Africa (Chile-Port)	930	72-96	50.00
Cbba-Iquique (Chile-Port)	1180	72-96	55.00
Cbba-Villazon (Arg-Frontier)	1480	72-96	45.00
Santa Cruz-Yacuiba(Arg-Frontier)	600	21	43.00
Santa Cruz-Puerto Suarez (Brazil-Frontier)	630	60	34.00

Standard road transport does not provide for ambiental control of the load, although the Flower Exporters Association (ASOBOFLOR) in Cochabamba had little trouble arranging for a local vehicle bodyshop to construct a 4.0x2.4x1.2 metre refrigerated box (Carrier chill unit) for use on a Volkswagen truck chassis at a total cost of US$40,000.

Instead, it is possible to obtain reefers (self-powered refrigerated containers) from the ports of Iquique, Africa or Matarani and use them on standard haulage chassis. Because the reefers are only available in the Pacific ports (and not in Cochabamba or Santa Cruz), it would probably be necessary to identify a product to haul from the ocean to Bolivia (possibly in association with a supermarket chain or other consumer of imported frozen product) in order to avoid the cost of moving an empty container. Transport of the reefers to the Pacific is charged at rates quoted above, plus a surcharge of 60-80% - supposedly imposed by the transporters because of the greater 'care' needed for handling containers. Given that containers were introduced specifically to reduce the amount of 'care' needed in the transport of goods, this justification rings rather hollow and it is likely that these quotes (provided to the MVA Consultancy team) are more of a bargaining position than a firm price.

Haulage costs for the containers by sea are covered in Section 7.3.4.

7.3.2 Rail Transport

Although often cheaper than road transport (see Table 7.3 below), rail suffers the disadvantage of extreme unreliability in delivery times. Stories are frequent of cargoes requiring a month or more to arrive from the Chilean ports by rail. Thus no perishable cargo must be transported by this method, despite the willingness of ENFER, the national railway company, to quote transport costs for fresh fruit. No refrigerated cars are owned by ENFER, although it would probably be possible to load reefers onto flat-bed rail cars.

Diagram 7.2 shows schematically the rail routes of interest for transporters. These include generally the same routes served by the road system, including the Peruvian and Chilean ports and the Argentinean and Brazilian frontiers.

TABLE 7.3: RAIL TRANSPORT ROUTES, DISTANCES AND COSTS

JOURNEY	DISTANCE (KM)	COST (US$/TM)
Cbba-La Paz	416	26-52
Cbba-Matarani (Peru Port)	58	
Cbba-Africa (Chile Port)	876	40-85
Cbba-Avaroa (Chile)	1136	48-103
Cbba-Villazon (Arg.Frontier)	808	38-80
Santa Cruz-Corumba (Brz.Frontier)	647	33-68
Santa-Cruz-Yacuiba (Arg.Frontier)	547	30-60
International:		
Yacuiba-Rosario (Argentina)		20-30
Yacuiba-Buenos Aires (Argentina)		25-35
Corumba-Campo Grande (Brazil)		9
Corumba-Santos (Brazil)		25

Once again, considerable discrepancy exists between different sources in some cases concerning freight rates. Where this has occurred an attempt has been made to obtain a third estimate and identify a majority opinion.

ENFER also possesses considerable warehousing capacity, particularly in Oruro and La Paz (see Section 6.3), although no refrigeration or chill facilities exist in these locations.

7.3.3 Air Transport

For perishable items and those with a high value to weight ratio, air transport offers considerable advantages for long distance transport. Air transport is of particular interest in the context of Bolivia due to the fact that the country lacks a coast and hence its own ports.

Unfortunately, Bolivia is not well served by international airlines, with for example, only LAB (Lloyd Aero Boliviano) and Eastern making direct flight to North America, and Aero Peru offering service with a change of equipment in Lima. In addition, direct flights are available to Santiago, Sao Paulo, Rio de Janeiro and Buenos Aires and connections can be made in these locations for European and Far Eastern destinations. In addition, the high altitude of the La Paz airport restricts cargo loads for planes taking of from this point.

Nor are the country's two main international airports (La Paz and Santa Cruz) well provided with handling facilities for perishable or frozen cargo. Neither airport possesses cold storage facilities (although ASOBOFLOR is planning on installing a reefer for cut flower handling at Santa Cruz), and even ambient storage facilities are extremely limited.

On the positive side, the lack of existing outgoing cargoes results in many planes leaving with less than full cargo loads, leading to favourable rates being offered from Bolivia in comparison, for example, with Chile (see Table 7.4). Under an export promotional program offered in conjunction with both passenger and freight flights, LAB offers transport to Miami for as little as US$0.37/Kg, while rates to such markets as Santiago, Buenos Aires and Sao Paulo are equally cheap. Even flights to Europe are available for as little as US$1.70/Kg. through Sabena (carried to New York via LAB) or US$1.80 with VARIG.

TABLE 7.4: AIR FREIGHT ROUTES, CAPACITY AND COSTS

ROUTE		AIRLINE	CAPACITY Kg.	COST US$/Kg.
Cbba-Miami		LAB Pass.	1,000	0.50
			5,000	0.37
		LAB Freight	5,000	0.69
		Eastern	-	2.38
Cbba-Santiago		LAB Pass.	1,000	0.62
			5,000	0.46
		LAB Freight	5,000+	0.25
La Paz-Santiago		LAB Freight	5,000	0.90
		LAN Chile	-	1.73
Cbba-Sao Paulo		LAB Pass.	1,000	0.34
			5,000	0.26
		LAB Freight	5,000+	0.25
Santa Cruz-Sao Paulo		LAB Pass.	5,000	0.22
		LAB Freight	5,000+	0.20
La Paz-Sao Paulo		VARIG	-	0.99
Cbba-Buenos Aires		LAB Pass.	1,000	0.42
			5,000	0.31
Santa Cruz-Buenos Aires		LAB Pass.	5,000	0.27
		LAB Freight	5,000	0.63
La Paz-New York		Eastern	-	1.88
La Paz-Los Angeles		Eastern	-	2.11
La Paz-Europe	(Via Lima)	Lufthansa	-	3.00
	(Via N.York)	SABENA	-	1.70
	(Via Rio)	VARIG	-	1.80
La Paz-Santiago-Miami		LAN Chile	-	4.52

SOURCE: MVA Associated Report (see Annex III)

It should be noted also that these fares are weight linked. ASOBOFLOR reports paying US$0.75/Kg. for freight to Miami under an agreement with LAB which guarantees the airline a minimum of 1,500Kg./month (although not necessarily on the same flight).

LAB's non-promotional fares are considerably more expensive and many of the cheaper rates are only offered on passenger services where space may be uncertain. The equivalent cost of a standard LAB freight flight to Miami is US$0.69/Kg., still cheaper than Eastern but nevertheless almost double that of the promotional fares. The conclusion seems to be that reliance on airfreight must be reserved for products of high value being shipped in relatively restricted quantities - preferably between 1,000 to 5,000Kg. in most cases. Furthermore, any marketing system for perishable commodities build around air freight would almost certainly require chill or cool storage facilities at Cochabamba and/or Santa Cruz airports, in case flights were delayed or had to leave cargo behind for weight reasons. In any case, cargoes originating in Cochabamba require at least 24 hours to reach Miami due to the poor fit of internal and international flight schedules. Flowers have to be loaded at approximately mid-day for the early afternoon flight to Santa Cruz where they await the 2 a.m. flight the next day to Miami, arriving the following morning.

7.3.4 Marine and River Transport

Although Bolivia's Eastern lowlands are drained by a series of rivers, the use of these waterways as means of commercial transport has been overlooked until recently.

The majority of the rivers eventually empty into the Amazon system, but the systems are unnavigable over many stretches in Bolivia and Western Brazil. Some rivers in the South of Bolivia, however, flow into the Parana system, leading to Rosario, Buenos Aires and Montevideo. In December of 1989 bulk soybean shipments were commenced over this route, utilizing barges, and delivering freight to Rosario in Argentina and Nueva Palmira in Uruguay. From these points they are often transhipped into ocean-going freighters for world-wide distribution.

This new system does not currently possess facilities for handling anything other than bulk grain-type cargoes and so is not an existing candidate for agroindustrial transport from the Chapare or Valles Altos. It should be monitored closely, however, as it is likely to eventually provide relatively cheap access to the extensive port facilities of Argentina and Uruguay and offer competition to existing routes through Peru and Chile.

Most non-perishable and bulk cargoes exported from Bolivia now are shipped through the Atlantic ports, particularly Matarani (Peru), Africa and Iquique (Chile). All are accessible by both road and rail, while Africa also has an air service from La Paz.

Rates determined by MVA staff (see Annex III) from Africa are given in Table 7.5 below.

TABLE 7.5: ROUTES, CARGO TYPES AND COSTS FOR MARINE FREIGHT

ROUTE	CARGO TYPE	COST (US$/MT)
Africa-Japan/Far East	Grains, Dry Cargo	122
	Fresh Fruits	262
	Refrigerated Fresh Fruit	437
Africa-European Ports	Fresh Fruit Juice	163
	Fresh Fruit	352
	Spices	347
	Fresh Vegetables	318
Africa-Miami/N.York/ Houston	Canned Goods	143
	Pepper	206
	Fresh Vegetables	254
	Refrigerated Container (fresh fruits)	5,500 (20' Ctr)
	Chilled Container (dried fruits)	2,000 (20' Ctr)
	Chilled Container (fresh fruits)	3,400 (40' Ctr)

SOURCE: MVA Associated Report (Annex III)

Estimated transport times for marine destinations are 40 days to North America, 50 days to Europe and 60 days to the Far East.

To these costs must, of course, be added approximately another US$50/MT for land transportation between Cochabamba and Africa or other Pacific ports. This would bring the overall cost of intercontinental transport for non-perishable cargo to a range of US$0.17-0.30/Kg. depending upon the destination.

If the assumption is made that a break-even in-bound load can be obtained (Africa or Iquique to Cochabamba), the total cost of transporting perishable cargo on the out-bound leg would appear to be little more than for regular cargo. Container rates (for North America) vary from 7-25c/Kg. depending on the shipper and the cargo, while even at the surcharge rates quoted under the road transport section, container delivery to the coast would appear to cost no more than another 10c/Kg. Overall cost of export of perishable goods (always assuming an in-bound load) can be estimated at US$0.20-0.35/Kg.

7.4 Conclusions

Communications facilities appear reasonably good for Cochabamba and Santa Cruz. As to power, however, the cost of electricity renders it an expensive energy source for industrial applications. Any major energy user should probably give careful consideration to the financial feasibility of establishing natural gas tanks and trucking in the gas in bulk.

Transport presents a severe constraint under existing conditions, at both the local and international levels. It should be remembered, however, that the quality of transport services may not be so critical for processed products as it is for fresh produce exports.

USAID is already engaged in upgrading road infrastructure in the Valles Altos, where the need is greatest. Plans are also underway to finish the paving of the remaining sections of the Cochabamba-Chapare-Santa Cruz highway. Once both of these tasks are completed the two regions will have relatively good road facilities with respect to their populations and economic importance.

The larger problem lies with the transport system itself, and particularly the predominant use of unpackaged cargoes, poor handling methods and mixed passenger/freight services. All of these factors lead to unacceptably high loss rates for fresh cargoes.

It is believed, however, that these conditions could be changed significantly were the situation modified in two respects:

1. The existence of a purchaser willing to pay for, and insist on, adequately handled produce. Such a market does not currently exist, providing no incentive for any market participant to expend effort and money on improving current practices.

2. The availability of technical assistance in post-harvest handling methods to train producers and transporters in necessary techniques and procedures.

It is clear that, even under current infrastructure, delivery systems could be significantly improved through the adoption of basic handling methods. Staff of the Italian funded Cooperacion Internacional program in Aiquile are delivering fresh strawberries to market in Cochabamba, Santa Cruz and Sucre using a very simple metal rack system placed into the rear of their pick-up truck. Trays filled with paper containers of strawberries are then loaded into the racks in a similar manner to that employed in airline serving trolleys. Transport losses have been reduced to almost zero using this system, which was put together from available scrap metal and cardboard punnets brought in from Italy.

International transport poses a different set of problems, centering upon the long distances to marine ports and the relatively limited availability of airline cargo space (available now but for only limited volumes). While refrigerated transport is possible and may well be necessary for a number of items, the additional cost of reefer hire and transport is significant and should be avoided where possible. For perishable products, such as fruit pulps etc. this appears possible only through the use of aseptic pack, which in turn requires major capital investment and expensive packing materials. Attention may be needed by reefer users also to the transport of refrigerated goods from the Atlantic ports, in order to make most economical use of the backhaul.

Nevertheless, transport costs in general do not appear as high as might be feared, particularly given the extreme emphasis placed upon transport as a constraint by many commentators. Air freight (in minor quantities) can be obtained for prices ranging from US$0.20/Kg. to $1.80/Kg. depending upon the destination, and road/rail/marine freight appears to fall in the range of US$0.20-$0.50/Kg. even if refrigerated transport is needed.

8.0 LEGAL AND FISCAL ASPECTS

8.1 Taxation of Agroindustrial Operations

At least six separate taxes are applied to agroindustrial enterprises in Bolivia, covering such areas as sales, capital value and specific product-related duties. These are discussed below.

8.1.1 Value Added Tax

Value Added Tax (Impuesto de Valor Agregado - IVA) is calculated upon all sales made by a company and is reduced by the value of IVA paid upon all purchases. In this manner it is similar to many other IVAs applied in Europe and elsewhere. The current rate is 10% and it is applied not only to goods but also to services, commissions, rentals and all other income earning activities.

Companies must be registered and include this IVA number on all invoices and receipts. Returns are made to the government on a monthly basis (Form 143) and payment must follow within 15 days. Positive amounts (arising from purchases exceeding sales) can be carried over to the next month. Companies are required by law to maintain two specific IVA account books - one for sales and one for purchases.

Two variations on the standard IVA exist for specialized areas such as independent consultants, professionals and shareholders.

8.1.2 Transaction Tax

This tax, known as the Impuesto de Transacciones (IT) in Bolivia, is levied at a rate of 3%, and applies to all transactions of a commercial nature undertaken on Bolivian territory. Paid monthly (Forms 156 and 169/172), it is generally filed simultaneously with IVA and is also calculated directly from sales receipts or invoices.

8.1.3 Specific Products Tax

The following categories of goods attract a specific sales tax above and beyond that of the IVA:

Beer	60%
Cigarettes	50%
Jewellery	50%
Perfume	30%
Wine & Liquor	30%
Soft Drinks	20%
Electricity	20%

Taxes collected under the Impuesto a los Consumos Especificos (ICE) are payed monthly (Form 114) or at the point of importation.

8.1.4 Imputed Company Profit Tax

The Impuesto a la Renta Presunta de Empresas (IRPE) is effectively a capital tax on companies calculated upon the difference between liabilities and assets. For agroindustrial and agricultural operations it is calculated effective the 28th of October of each year and is imposed at a rate of 2%. Taxes are calculated under Form 39.

8.1.5 Imputed Owners Profit Tax

The Impuesto a la Renta Presunta de Proprietarios de Bienes (IRPB) is applied on all vehicles and urban buildings at the following rates:

Automobiles	1% Municipality
	0.5-4.0% Government
Motorboats	1% Municipality
	0.5-4.0% Government
Airplanes	1% Municipality
	2% Government
Urban Buildings	0.35% Municipality
	Variable% Government

Payments are levied at half the overall rate, twice a year.

8.1.6 Rural Property Tax

A companion to the above tax, the Impuesto a la Propriedad Rural (IPR) varies according to property location (base values are estimated Provincially) and the size of the holding. Generally, taxes are levied at the rate of 1% on small holdings, 1.5% on medium holdings, and 2% for large holdings. Payments are levied at half the overall rate, twice a year.

8.1.7 Other Taxes

A number of other taxes are applied to specific occupations and businesses that are not directly linked to agroindustry. Among these are included transport companies, small traders and artisans.

It should also be noted that the law requires many types of businesses, especially those involved in exports of goods or services, to be registered with, or members of, various Chambers of Commerce, Exporters Associations etc. Membership fees are levied against member firms according to their size.

8.2 Export Procedures and Requirements

In theory, at least, all goods that do not fall within the categories of military goods, narcotics and dangerous substances, may be exported freely without previous licence or clearance. Non-traditional exports (defined as all except petroleum products and minerals) can be exported free of all taxes. Furthermore, exporters are entitled to reclaim any IVA paid on imported or locally purchased goods used in the manufacture of exports.

All foreign currency derived from export sales must be turned over to the Central Bank but this rule is of little importance under the current regime as dollars and other hard currencies are freely traded.

Exporters may also claim a government refund under the Duties Compensation Certificate (Certificado de Reintegro Arancelario - CRA), set at 10% of the net value of all non-traditional exports (with the exception of wood products, jewellery and a few other categories). Given that IVA is already reimbursed, the CRA is effectively a subsidy to exports.

Under new regulations promulgated on the 11th January, 1990 and still not fully defined, an attempt has been made to simplify export procedures and to promote the establishment of duty free zones and maquilas (enterprises assembling imported components for subsequent export).

8.2.1 Registration

All exporters must be registered with 4 different organizations as follows:

- The Municipality where the business is established, to obtain a certificate of Municipal Operation
- The Tax Department, to obtain a registration card for deducting contributions (Registro Unico de Contribuyente - RUC)
- The Ministry of Industry and Commerce, to obtain an exporter's certificate
- The National Exporters Association, to obtain a registration card

The first three of these registrations applies to any legally established business operating in Bolivia whether they are exporters or not.

8.2.2 Required Documents

In addition to the registrations described above, an exporter requires a minimum of eight separate documents to formalize a legal export of goods from Bolivia. These documents are briefly defined below.

COMMERCIAL INVOICE:

Prepared on the exporting company's letterhead, and including full details of the order (volume, value, shipment method, terms of sale, destination etc.), as well as relevant registration numbers and legal status of the exporting firm.

Sales details must be broken down such that the net value of the export can be determined and the invoice must contain a sworn declaration of a representative of the firm concerning the accuracy of the statements therein.

CERTIFICATE OF ORIGIN:

This document varies according to destination of the goods but is in most cases derived from -

Department of Overseas Trade (DICOMEX), where the destination is a member country of ALADI
The local Chamber of Commerce, where the destination is a member country of GATT
The Bolivian Coffee Committee (COBOLCA), where the export is a coffee product

QUALITY INSPECTION CERTIFICATE:

This certificate (Aviso de Conformidad) certifies that the product meets claimed standards of quality, volume and price. It is provided, on a voluntary basis and free of charge, by two non-governmental agencies 'Bureau Veritas' and 'Specialist Services International' where the exporter submits samples for inspection.

The service is stated to be mandatory for receipt of the CRA (see Section 8.2) and the processing of foreign exchange (DHV, 1989'p.11).

PACKING LIST:

Prepared on letterhead of the exporting firm showing standard packing details (number of cases/cartons etc., markings, contents, weight, destination etc.).

CARGO MANIFEST:

This document is issued by the transporting company, and conforms to usual international norms.

LOADING CERTIFICATE/AIR WAY BILL:

Provided also by the transport company, this document provides proof of embarkation or loading of the cargo on board the ship, plane, or truck etc.

INSURANCE CERTIFICATE:

Only essential in case of shipment CIF (Cost, Insurance and Freight), the insurance certificate may be needed also where delivery is FOB coast (Matarani, Africa etc.).

EXPORT POLICY:

This document must be purchased from the Customs Authorities and filled in twelve copies by the exporter or shipping agent. It is used by government not only for customs control but also for legalizing CRA (see above), statistical purposes and control of foreign exchange earnings.

PHYTOSANITARY OR SANITARY CERTIFICATE:

One of these two certificates will be generally required where the exported product is of plant or animal origin and/or is intended for human consumption. Additional certification of phytosanitary inspection may be required also by the importing country but these regulations vary extensively and can not be quoted in general terms.

The Phytosanitary certificate is issued by the Department of Plant Health, Ministry of Agriculture and Peasant Affairs.

Although the above descriptions derived from a report by DAA Consult (see Associated Report - Annex III) tend to leave the impression that the process is straightforward, a 1986 study undertaken by CORDECRUZ (Thompson;p.11) suggests that the reality can be considerably more painful.

In a test case followed through by the researcher, it was determined that meeting the requisites for documentation for export required some 280 separate questions directed at a wide variety of government and other agencies, and involved filling in 114 copies of different forms with 19 different signatures.

The author points out that the Export Policy and Exporter's Certificate (see below) were introduced when government authorization for export was still required and were originally designed for that purpose. Even though that need no longer exists the forms continue to be circulated, with recipients including, among others, the Mining Bank of Bolivia and the Ministry of Mines and Metals. These last two, as the author points out "surely for purely historical reasons".

The study goes on to point out that most European importing nations, for example, require only two documents - the commercial invoice and the certificate of origin - with the weigh bill or loading certificate also being required by the importing company. By comparison with Bolivia, the study points out that Brazil requires only two documents of exporters. It is possible, however, that the changes announced in January, 1990, will lead to some rationalization of the system in Bolivia.

8.3 Investment in Agroindustry

All commercial companies in Bolivia fall within one of the categories of Sociedad Anonima (S.A.), Sociedad a Responsibilidad Limitada (S.R.L) or a Sociedad Mixta (S.M.). No attempt will be made in this rapid appraisal to enter into legal definitions of these three types of organization.

The DAA Consult study details eight stages in the creation of a company (see Associated Report - Annex III; p.19), all of which would normally be handled by a local lawyer at a cost between 1-4% of the total capital value of the company.

A company established as an S.A. must have a minimum of 5 members, while S.R.L.s and S.M.s must have a minimum of two members. Companies can not have an indefinite lifespan and the duration of the 'Sociedad' must be specified in the company charter. There is no minimum capital amount to establish a company. However, for an S.A. the subscribed capital must equal at least 50% of the authorized capital.

At the moment of registration, paid up capital must equal 100% for an S.R.L. and 25% for the other two types of company, with the balance payable within one year.

The DAA Consult report states that company establishment requires from 15 days to 3 months depending upon the shareholder structure.

An agroindustrial enterprise requires two additional stages in its establishment involving registration with the Ministry of Industry, Commerce and Tourism and with the Ministry of Public Health. Requirements for this registration are included in the DAA Consult Associated Report (See Annex III;p.22).

8.3.1 Foreign Investment

The Supreme Decree 22407 of January 1990 provides for various guarantees for foreign investors, including those entering into joint-ventures. These include:

Equality of rights, duties and guarantees among both national and foreign investors

Equality of tax treatment

Equality of rights to property

Guaranteed open exchange conversion, without any restriction on the entry and exit of capital, the repatriation of profits, interest payments, dividends, licensing fees or any other type of commercial transaction.

Guarantee that any contracts, judicial acts, operations or other financial obligations of commercial life can be paid equally in foreign exchange or local currency

Free contraction of investment insurance within and outside of Bolivia

Freedom of importation of goods and services into Bolivia

Freedom of production and sale of goods and services within Bolivia

Freedom to agree to, or terminate, employment contracts and payments to workers in accordance only with contractual agreements between the two parties.

Joint-ventures are recognised as private or government in nature, which may involve individuals, both Bolivian and foreign, who associate for the purpose of developing work, projects, undertakings, services or other efforts. They can operate within or outside the territory of Bolivia but foreign

participants must establish a legal presence in Bolivia and fall under national laws with respect to their joint-venture operations.

The joint-venture is not recognised as a commercial entity but joint-ventures must be recorded in the business register (Registro de Comercio) and state:

> The object, duration, nature, and legal domicile of the joint-venture, with details of the participants and the name and address of the legal representative.
>
> Obligations, contributions, system of sharing of benefits and costs and method for dissolving the joint-venture.

8.4 Foreign Exchange

Since the hyperinflationary period of 1984-85, the Bolivian currency has remained remarkably stable. Converted from the old Peso at the rate of 1,000,000 to 1, the Boliviano has devalued by less than 7% over the last 18 months, being traded at approximately Bs.3.06/US$1 in March of 1989.

Many aspects of business are still conducted with reference to US dollars, including bank loans (for both business and personal purposes), prices of capital goods, and even salaries. Open exchange markets exist in banks and other financial institutions, exchange houses (Casas de Cambio) and on most street corners in major cities.

As outlined in the section above, the Decree promulgated in January, 1990, guarantees a continued policy of open and freely traded foreign exchange, and while it is impossible to predict future events with respect to exchange rates, the memory of the hyperinflationary period of just 5 years ago is a powerful incentive for Bolivians to avoid tampering with a currency that is currently stable.

8.5 Relevant Institutions

A study undertaken by DHV for the World Bank has identified 5 principal state institutions involved in export development and control as well as 3 private institutions and 1 mixed. These are briefly described below.

8.5.1 Government Agencies

PROBOL:

The Promotional Council for Exports Investment and Tourism in Bolivia (PROBOL) is headed by the Minister for Industry and Commerce and includes representatives of the Ministers of Finance and Planning, Agriculture and Peasant Affairs, Mines and Metallurgy and the President of the Bolivian Confederation of Private Business (CEPB).

The group has responsibility for the overall planning and promotion of activities in its area and, most importantly, the coordination of efforts undertaken by each of the members agencies.

CENTRAL BANK:

The Central Bank establishes the official exchange rate, through the release of foreign currency under a series of 'auctions' and the publication to the general public of the rates obtained. Approximately US$5 million are typically offered at each trading session.

The Central Bank receives, by law, all foreign exchange generated by exports from Bolivia. It is these funds that are used to support the foreign exchange sales. The Central Bank is also responsible for issuing the Duties Compensation Certificate (CRA) once the requisite foreign exchange amounts have been delivered to it.

The Central Bank is also responsible for funding various lines of credit (including those for export and for agricultural production) handled by intermediate financial institutions and establishing rates of interest within Bolivia for these and other loans.

CUSTOMS DIVISION:

Falling under the Ministry of Finance, the Customs Division (Direccion General de Aduanas) is responsible for controlling all movement of goods into and out of Bolivia. This task includes the issue of Export and Import Policies for commercial companies.

The Customs Division is also responsible for the collection and control of Value Added Tax (IVA) and the Specific Products Tax (ICE).

FOREIGN TRADE DIVISION:

This unit (DICOMEX) of the Ministry of Industry and Commerce is responsible for all aspects of foreign trade. It issues Certificates of Origin, manages international and bilateral agreements, processes data related to exports, issues import licences where necessary and informs the Central Bank as to issue of the CRA.

DEPARTMENT OF PLANT HEALTH:

A department within the Ministry of Agriculture and Peasant Affairs, Plant Health is responsible for the inspection of all exported plants and agricultural products and the issuance of Phytosanitary Certificates based upon international standards.

8.5.2 Parastatal Institutions

INPEX:

The National Institute for Export Promotion (INPEX) was established in 1987 to assist in the development and promotion of non-traditional exports.

Under this mandate, INPEX was responsible for conducting market studies, identifying export constraints and needs, providing assistance to exporters in obtaining credit, market contacts, shipping and transport, as well as in participation in international fairs and shows.

INPEX was also intended to establish and maintain a data bank relating to export opportunities, prices and quality standards and to provide and coordinate training programs for exporters and Bolivian industry in general in relation to export requirements.

INPEX was supported by USAID through technical assistance and funding until the beginning of 1990. Its performance, however, has been such that this funding has been discontinued and INPEX can no longer be seen as a significant participant in the export sector.

8.5.3 Private Sector Institutions

NATIONAL EXPORTERS ASSOCIATION:

A federal body, representing Exporters' Associations in each of the 4 larger Departments of the country (Santa Cruz, Tarija, Cochabamba, La Paz), the CNE is also, in turn, a member of the Bolivian Federation of Private Business.

Its prime responsibility is to represent the interests of the private exporter to the government in terms of policy and planning.

BUREAU VERITAS and SPECIALIST SERVICES INTERNATIONAL:

These are both international organizations contracted by the Government of Bolivia to verify and check quality and other standards associated with the export of goods from the country.

Among checks carried out under this program are weight, quality, volume, price and labelling.

PRIVATE BANKS:

Private banks play three important roles with respect to export procedures in Bolivia. Firstly, they are able to open letters of credit with foreign institutions for the payment of invoices for imports, or the verification of letters of credit supplied by buyers for export goods.

Secondly, the commercial banks constitute the prime window for the purchase of foreign currency, through the medium of the weekly currency sales. Thirdly, the banks act as lending windows for exporters credits.

8.6 Conclusions

In general, the legal and fiscal position of exporting agroindustries in Bolivia in comparison to other Latin American and developing countries is very favourable. Although a considerable amount of bureaucratic procedure does still appear to exist with respect to the documentation of exports,

the economic and legal policies of the country, particularly with regard to foreign investment, have been almost exemplary (in theory at least).

In such areas as the stability and convertibility of foreign exchange, the rights and opportunities of foreign investors, the availability of tax concessions for exporters of non-traditional goods, and the policy with regard to joint-ventures, the Bolivian government has provided a climate much more favourable than most of its neighbours.

The key area of weakness for agroindustrial producers and exporters appears to lie primarily in the poor performance and lack of results obtained by INPEX. Although this lack may not matter much to major international concerns already well established in international markets, and with an extensive knowledge of export procedures, the failure of the Government to develop an effective assistance mechanism will inevitably impact severely upon small and medium sized exporters wishing to enter the market for the first time, or expand existing limited markets.

It is strongly recommended that careful consideration be given to a reappraisal of INPEX activities and results, with the intention of identifying either improved methods for permitting INPEX to achieve its objectives, or of identifying other organizations or groups who could successfully take on the task.

Encouragement should also be given to the Government of Bolivia where possible to continue the open economic, fiscal and commercial policies that have been pursued up until now, and to further simplify, where possible, the onerous documentation requirements that still exist.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The foregoing systems appraisal has highlighted a number of areas - both positive and negative - with respect to the functioning of the agroindustrial marketing system in Bolivia. Before turning to a detailed summarization of these findings, however, it is perhaps useful to discuss a key general issue arising from the overall study.

More than any other aspect, the study has made it clear that the current system provides almost no linkage between different elements of the marketing system. Processors have very little to do with producers and packagers have no connections with transporters. The result of such a fractured system is that participants undertake activities without reference to the needs of system participants in other segments. This in turn means that suitability of operations in one segment (e.g. packaging) for needs in another segment (e.g. transport) is largely a matter of chance.

Although this lack of interfacing between market segments can be blamed partly upon poor communications and failure to cooperate between different participants (e.g. the concept that processors and growers are, in some way, 'enemies' and must fight each other for an advantage), it arises even more significantly from the inability of one segment in Bolivia to provide a reliable market for output from another segment. With markets both unreliable and uncertain, participants rapidly learn the dangers of specialized approaches requiring high levels of capital investment. Risk minimization becomes paramount. Thus growers produce a variety of crops (with low inputs of fertilizers and chemicals), transporters carry a range of cargo in unspecialized vehicles, and packaging companies prefer to produce generic packaging materials. The advantages that come from specialization - such as varieties specifically grown for processing, or transport specifically adapted to agricultural produce - are therefore lost.

This situation was noted repeatedly by the team during their investigations in Bolivia. Every time it was encountered the root cause was inevitably attributed to the lack of secure markets. Nobody could adequately develop their own segment of the system because the buyers in the next segment could not be depended upon. Experiences such as those of Vascal with their Tetra-Brik subsidiary (SEASA) - a factory equipped with the most modern machinery running at only a small fraction of potential capacity - have only confirmed this failure of the markets in the eyes of many Bolivians.

The implications of this splintered system and the cynicism which accompanies it are twofold. Firstly, secure demand must precede, or at least accompany, market system strengthening. Technical assistance and financing may be a requirement for system development but it is not sufficient on its own. No amount of training will convince growers or transporters to change their procedures and habits unless participants gain confidence in the functioning of the system.

Secondly, the identification and exploitation of appropriate markets is not merely a way of generating revenue for growers and other market participants - important as that may be. It is also a critically important lever by which the entire agricultural marketing system in Bolivia can be forced into developing as an integrated system, a change that could have profound impacts on the entire Bolivian economy in the long run.

With these observations in mind, the following two sub-sections summarize specific system opportunities and weakness that reflect upon that lack of system integration.

9.1 Key Opportunities in Market Development

Although it is not difficult to identify potentials within the agroindustrial marketing system in Bolivia, it is clear that the vast majority are no more than that - potentials. That is to say, while there is much that suggests sources of growth and strength within the system for the future, few aspects of the current marketing system can be viewed as strengths at the moment. The challenge, therefore, is to create the conditions under which these potentials can develop into productive aspects of a dynamic and efficient system.

Below, some of these potentials are identified by system segment.

RAW MATERIAL AVAILABILITY

- **The agronomic potential of the Chapare appears high, despite poor soils in some areas.** A wide variety of crops appears to have the attributes and requirements necessary for production in this region, although care must be taken to match soil conditions with crop types.

- **There may be unexploited crop opportunities in Valles Altos.** Little real diversification research has occurred in this area, while preliminary analyses suggest a number of semi-arid crops which might adapt well to local conditions.

- **Some raw materials are available at extremely low cost.** The current limited production alternatives and restricted markets have led to a number of products (e.g.tomatoes) being available at seasonally very low prices. This in turn suggests that competitive production may be possible on world markets.

ACCESSING RAW MATERIALS

- **Strong interest appears to exist in diversifying away from coca.** Due to declining prices in recent months and market instability, there is - perhaps for the first time in more than a decade - real grower interest in developing new crops.

- **Labour availability is good and costs are low.** Due to declining employment in the coca sector there is an increased availability of casual labour for farm work.

- **Producer groups are already in place for some products.** Work by PDAC, the UN 412 Program and other groups has led to the formation of a number of specialist producer groups dedicated to specific crops.

- **A number of active NGOs are present in the agricultural sector.** Volunteer organizations are already active, particularly in the Valles Altos, in the agricultural and rural development sector.

- **The traditional sindicato structure suggests the ability of producers to develop well organized supply groups.** Sindicatos are powerful elements of Bolivian rural life. This strength could contribute to the development of coherent farmer groups.

- **Resources exist for technical and credit support of new crops.** Through such organizations as the PDAC, farmers and other system participants have access to technical assistance and financial support.

PROCESSING FACILITIES AND CAPABILITIES

- **Cochabamba and Santa Cruz contain a considerable number of innovative entrepreneurial small-scale producers.** These entrepreneurs are keen to increase their technical proficiency and product quality.

- **Considerable idle capacity exists in most larger agro-processing operations.** This idle capacity could provide increased output in a number of areas without major new capital investment.

- **Some local processing technology has already been developed.** Local capacity already exists, for example, in the areas of extraction and distillation.

- **Some capability already exists for processing research and quality assurance.** The Agroquimico program, as well as other departments of UMSS, already have considerable capacity for chemical, physical and biological analysis.

- **Concessional financing may be available through USAID and UNDP programs.** This financing can reduce the equity cost of new and expanded processing facilities, where needed.

PACKAGING AND STORAGE

- **Certain bulk packaging materials exist at relatively low cost.** Packaging cost need not be a major impediment to export development if bag-in-carton shipment is feasible.

- **Local capacity exists to construct cold-storage facilities.** Such facilities can be fixed, container-based or truck mounted, permitting the establishment of cold chains and pre-cooling facilities at moderate expense.

- **It is possible to establish a cold-chain to the Pacific ports.** Using refrigerated containers, it is possible to transport frozen product to the principal Chilean and Peruvian sea-ports. A new facility providing dry-ice for low temperature shipping is now available in Cochabamba.

INFRASTRUCTURE AND TRANSPORT

- **Infrastructure availability in Cochabamba and Santa Cruz is good.** Processing plants and other agroindustrial operations have access to all facilities needed.

- **Good main road access exists to the Chapare region and access to the Valles Altos is being improved.** Local transport conditions are generally of an acceptable standard.

- **Air freight is possible at reasonable prices direct from Cochabamba.** Utilising LAB's promotional fares, in particular, provides extremely economical freight rates to North America, Argentina and Brazil.

- **Transporters appear responsive to new patterns of demand.** Evidence suggests that where business can be identified, transporters will rapidly modify practices to meet new types of demand (e.g. delicate loads).

LEGAL AND FISCAL ASPECTS

- **Exchange rate stability is good.** Since the hyperinflationary period of the mid-1980s, maintaining exchange rate stability has been a high priority for the government.

- **Export industries are encouraged and export incentives are offered.** Such aspects as reduced transport rates, tax credits and duty-free imports for export industries are all offered to exporters.

- **Bolivia receives favourable customs treatment from many industrialized countries.** As one of the regions least developed countries, Bolivia receives favourable customs treatment both internationally and from its neighbours.

- **The government guarantees equal treatment and free movement of funds to foreign investors.** Bolivia provides one of the most liberal foreign investment regimes in the world and guarantees freedom of repatriation of profits, investments, licensing fees and dividends.

9.2 Key Constraints to Market Functioning

Unfortunately, unlike the positive aspects of the marketing system, the constraints are often not potentials - they are problems that exist currently and contribute directly to the poor performance of the existing agroindustrial marketing system. Even so, these constraints can be expected to grow in importance as the agroindustrial sector expands. For effective system development, therefore, these problems must be recognised and measures taken to ameliorate their impact in the future.

RAW MATERIAL AVAILABILITY

- **Many of the most promising crops are not in commercial production.** Furthermore, planting material availability may be limited, further delaying commercial production

- **Irrigation potential appears poor for most of the Valles Altos.** Non-irrigated areas will be severely restricted in the range of crops that can be grown.

- **Soil erosion and degradation risks may exist for high-altitude areas in the Chapare.** It is exactly in these steeper, high-altitude areas that some crops (e.g. coffee, tea, cocoa, cardamom) appear to grow best.

ACCESSING RAW MATERIALS

- **There is limited use, or knowledge, of procedures to produce export quality output.** This is especially true in areas such as use of pesticides, high-yield varieties, husbandry techniques and product selection.

- **Land tenure systems may impede the establishment of large core farms.** Family owned holdings, combined with settlement grants for the Chapare, may render it difficult to amass major holdings needed for dedicated agroindustrial raw material supply.

- **Most producer organizations have only small memberships and limited management skills.** Considerable strengthening work will be required before such groups are capable of managing their own activities.

- **Current post-harvest handling systems are rudimentary at best.** Existing systems lack specialised handling systems, post-harvest treatments, grading standards or many other features.

PROCESSING FACILITIES AND CAPABILITIES

- **Existing technology is generally rudimentary.** Except in the case of one or two large processors, the industry is working with antiquated and inadequate technology.

- **The agroindustrial sector has almost no experience of exporting.** This lack of experience reduces their confidence and limits their ability to exploit new market opportunities.

- **Commercial financing is difficult to obtain and expensive.** Due to strict anti-inflationary and foreign exchange management guidelines,banks require heavy security for capital loans.

- **Almost all machinery and equipment must be imported.** This renders the establishment and replacement of all equipment an expensive proposition.

PACKAGING AND STORAGE

- **All packaging raw materials are imported.** No packaging materials are manufactured in Bolivia; only processes such as extrusion from plastic pellets and crimping and forming of Kraft paper are undertaken.

- **Consumer-size packaging is extremely expensive per unit volume.** No exports can be considered utilising consumer packaging. Even domestic sales of Bolivian produce has difficulties in competing with Brazilian or Chilean cans etc.

- **Commercially available cold-storage space does not exist.** It is impossible to rent or lease cold storage space in Bolivia - even at the international airports.

- **Aseptic packaging methods will probably only be economically feasible for large-scale processing operations.** Due to the cost of even a small aseptic packaging line, this system is only feasible for larger operations.

INFRASTRUCTURE AND TRANSPORT

- **Basic infrastructure is lacking in both producing areas.** Such facilities as electricity, water and telephones are almost totally absent in the Valles Altos and Chapare.

- **Existing road access to parts of the Valles Altos is extremely poor.** Areas such as those around Omereque, for example, can be almost unreachable in the rainy season. The USAID road improvement program will take some years to reach this area.

- **Local transport systems are not adapted to perishable cargo transport.** Current produce transport is generally loose or in bags, and loss rates are high.

- **Non-air freight export products must bear cost of transport to coast.** Products being exported by sea must undergo a journey of some 3-4 days to reach the Pacific coast, with its associated cost.

- **Air freight space is limited.** Only LAB offers concessional freight fares, and even higher cost space may be difficult to obtain in significant quantities due to the restricted number of carriers serving Bolivia.

LEGAL AND FISCAL ASPECTS

- **Export documentation is cumbersome and lengthy.** Although new regulations were passed in January of this year, procedures up to this point have been lengthy and difficult.

- **Bolivia lacks an effective export information and promotion service.** Despite efforts to support the creation and development of INPEX, Bolivia still lacks an effective service to assist potential exporters.

9.3 Recommendations for Marketing System Improvement

In the introduction to this section it was suggested that the development of an efficient agroindustrial marketing system would require attention in two areas; the identification and securing of markets (primarily international markets), and the provision of assistance in strengthening and coordinating individual segments of the marketing system. The recommendations provided below address the second of these areas.

Each of the market segments discussed in this report has its own needs, and each of those needs must be related to the requirements of other segments within the system. Drawing from the findings of the system study summarized above, therefore, the following key needs can be posited for the system:

RAW MATERIAL AVAILABILITY

- Increased knowledge of agronomic potentials/constraints associated with non-traditional and 'new' crops, especially in the Valles Altos

- Improved availability of appropriate planting materials for selected crops (i.e. varieties suited to processing)

ACCESSING RAW MATERIALS

- Improved extension services (reaching a far greater number of growers) linked to processors needs

- Strengthened producers' and growers' associations, particularly in areas of financial and administrative management

- Improved knowledge of post-harvest handling requirements, both on farm and in delivery to the plant

PROCESSING FACILITIES

- Attention to improving the technological and quality standards of smaller processors

- Easing of access by processors to capital and working funds

- Joint-ventures may provide a feasible route for overcoming existing problems

PACKAGING AND STORAGE

- Focus upon the identification and development (where feasible) of lower-cost aseptic packaging processes, to reduce dependency upon refrigerated transport

- Development of commercially available chill and cold store facilities, especially at transhipment points such as airports

INFRASTRUCTURE & TRANSPORT

- Education of transport operators in requirements for transporting perishable and fragile goods

- Improvement in infrastructure in producing areas (to power cold storage and pre-processing operations)

- Continued efforts to upgrade road quality in the Valles Altos

LEGAL AND FISCAL ASPECTS

- **Continued attention to reduction in paperwork associated with exports**
- **Restructuring of INPEX, or creation of alternative exporters' assistance centre**

9.3.1 Specific Implementation Activities

The present report comprises the first of three outputs that will be delivered to the USAID Mission to Bolivia by the AMIS team. The other two elements, covering national and international market studies, and the results of discussions with North American agribusiness firms concerning joint-venture or purchasing agreements for Bolivian products, are still to be completed.

The results of these subsequent tasks will inevitably have a major impact upon the nature of the agroindustrial marketing system that will need to be developed in Bolivia. The market studies, for example, will influence the type of products targeted (fruits, spices, essential oils etc.) and, through them, the type of infrastructure required (transport systems, cold storage facilities, processing technology, the choice of air or marine transport etc.). The results of discussions with North American agribusinesses could have an even more profound effect upon system development. A key objective in attempting to involve such companies is not only that they may be capable of delivering reasonably secure markets, but that they will also possess a detailed and current knowledge of system needs for the particular products that they are accustomed to handling. Should a number of companies decide, therefore, to participate in some form of agroindustrial activity in Bolivia, they would be very likely want to (a) specify the type of infrastructure, technology and human resources required to handle their particular product, and (b) participate in overseeing or coordinating the development of those components.

As a result, it is extremely difficult and perhaps somewhat rash to present recommendations for specific implementation activities at this point - at least in terms of specific positions to be filled and storage structures to be built. Nevertheless, the AMIS team fully realizes that USAID Bolivia may have a need for an early assessment of the scale and scope of activities that are likely to be required. For this reason, this report attempts to state requirements without specifying which agency, organization or company is likely to provide them, or the precise nature and dimensions of the investments needed.

SHORT TERM ACTIONS

A number of actions will probably be required in the short-term, in order to provide additional information not collected as part of the AMIS study. Among the areas where further information is required are:

- For those crops determined to have strong market potential, the preparation of realistic financial feasibility estimates including cost-of-production, processing and packaging costs and shipping. These costs can then be compared with likely world or regional market prices to determine the attractiveness of the products to system participants (growers, processors etc.). This analysis would be expected to require a three person team (economist, agronomist, processor) and last approximately 2-3 months, depending upon the number and nature of commodities to be reviewed. This task may be undertaken by any combination of USAID/AMIS staff, PDAC staff, North American/Bolivean agribusiness representatives.

- Once specific markets, volumes and returns are identified, detailed discussions must be held with other interested groups in Bolivia to determine their willingness and ability to cooperate in market development activities. Such groups might include producers' associations, the UN 412 Program, Agroquimico (quality control), individual processors, packaging companies etc. Both USAID and PDAC should be represented in such talks, as should international buyers (if participating) and AMIS staff.

Furthermore, detailed agronomic data is still lacking with respect to a number of the 'New' product categories identified in Section 3.3. Should any of these products be determined to possess strong market potential it may be necessary to arrange for agronomists experienced with these particular crops to review their performance and potential in the Bolivean context. Once again, these individuals may be representatives of North American agribusiness firms, USAID/AMIS staff, PDAC staff or a combination of each.

LONG TERM IMPLEMENTATION

The completion of the above activities, added to the results of the three elements of the current AMIS study - the systems appraisal, the market studies and the agribusiness contacts - should place USAID/PDAC in a position to put together a detailed plan for medium to long term development of the sector.

Although the detailed elements can not be defined in detail at this point, it is possible to identify the broad outlines of such medium/long term activities.

Long-term technical assistance, either provided by USAID or possibly by purchasing companies from North America, will almost certainly be needed in the following areas:

- Institutional strengthening of producer groups and farmers' associations. Assistance would probably focus upon administrative controls, financial management, communications skills, and some areas of extension to members/growers.

- Post-harvest extension services development would be essential to strengthen the current efforts of IBTA Chapare, producers' associations and Valles Altos based NGOs in dealing with growers. Special attention should probably be given to harvest procedures, on-farm packaging, post-harvest treatments, local storage, and delivery to processors.

- Small-scale agroindustrial technologies, involving assistance to processors and packaging companies in upgrading their skills and technology with respect to agroindustrial operations. Particular linkages could be established between this advisor and organizations such as Alternative Technologies Inc. and the Executive Volunteer Service in the U.S.A.

Financial and investment assistance will also probably be required in a number of infrastructure related areas, although this investment may be derived from commercial operations by Bolivean or North American firms as well as, or instead of, USAID funding. Areas of probable importance include:

- Upgrading plant propagation and nursery facilities. Additional nursery sites will probably need to be developed (especially in the Valles Altos), and improved technology in areas such as meristem tissue culturing may have to be introduced.

- Improved field trial and applied research facilities may be required in the Valles Altos, to complement those at La Jota and Chipirirri in the Chapare. Trials work being undertaken by CEDEAGRO in Mizque and Cooperacion Internacional in Aiquile could, for example, be expanded. New facilities would permit testing of proposed new crops.

- Establishment of storage facilities in one or more of the Chapare, Valles Altos, Cochabamba and possibly at the international airports may be required. Such facilities would likely include both ambient and cold storage space. Given the absence of rental reefers for transport of chilled and frozen product to the Pacific coast, the selection of perishable products will almost certainly require the purchase of refrigerated containers (reefers) - it is not clear at the moment, however, whether any financial assistance would be required from USAID to finance such purchases

- USAID should continue with its road improvement efforts in the Valles Altos.

APPENDIX A: FIELD TRIP ITINERARY

APPENDIX A: FIELD TRIP ITINERARY

Date	Location	Activity/Meeting
March 6 p.m.	La Paz	Arrive La Paz
March 7 a.m.	La Paz	Meeting with Ney Lopez, USAID Adviser to PDAC (Marketing & credit)
		Meeting with USAID ARD Office Staff
March 7 p.m.	La Paz	Flight to Cochabamba
March 8 a.m.	Cochabamba	Review of Documents
March 8 p.m.	Cochabamba	UMSS Facultad de Sciencias Quimicas
March 9 a.m.	Cochabamba	UMSS Facultad de Sciencias Agricolas (Dptos. de Alimentos y de Phyttecnica) Ing. Mario Quiton
March 10 a.m.	Cochabamba	Estacion Experiental 'Pairumani' Ing. Mario Crespo
March 12 a.m.	Cochabamba	Meeting with PDAC Director, Lic. Jose Decker
		Visit to ROTOPLAST S.A. Plastics Factory, Ing. Hans Eisner
		Visit to FABE S.A. Metals Factory
March 12 p.m.	Cochabamba	Visit to LA LUZ, Manufacturer of glazed fruits, Sr. Mario Aramburo
		UMSS Los Valles Altos Socio-Economic Survey Team (CEFOIN), Dr. Carlos Perez
		Equipo Chapare, Mr. Duane Anderson
March 13 a.m.	Valles Altos	Centro De Desarrollo Agropecuario (CEDEAGRO) Ing. Gonzalo Reynaga & Ing. Rely Rojas
		IBTA-PRODEVE, Lic. Sergio Gutierez, Sr. Rider Andrade & Ing. Benijno Lopez
March 13 p.m.	Valles Altos	Asociacion de Servicios Artesanales y Rurales (ASAR), Ing. Benjamin Cartagena
		Cooperacion Internacional, Ing. Elio Pedrotte
March 14 a.m.	Valles Altos	Radio Esperanza, Padre Floriano Wess

March 14 p.m.	Cochabamba	United Nations Program 412 (Agroindustry) Lic. Jaime Hidrobo, Manager & Lic. Carlos Bravo, Marketing Specialist
March 15 a.m.	Chapare	Travelling
March 15 p.m.	Chapare	IBTA Experimental Station 'La Jota' Ing. Max Rojas & Ing. Victor Olivero
March 16 a.m.	Chapare	United Nations Program 412 Field Station, Lic. Jaime Hidrobo
		Lemon Grass Oil Producers Association facilities and plant
		Tea processing plant, CORDECO
March 16 p.m.	Chapare	United Nation Program 415/ Projet Gilead, Dairy Processing plant, Jean-Erik Matensson
March 16 p.m.	Santa Cruz	Pineapple processing plant, COBOCE-ENAVEL, Ing. Jaime Mendez, Mgr.
March 17 a.m.	Santa Cruz	Meeting with Ing. Thiery Givois, D.A.A. Consult
		La Granja, Fruit Processing plant, Jose-Luis Abuawad
March 17 p.m.	Santa Cruz	Meeting with Calvin Miller, Menonite Economic Development Agency
March 18 p.m.	Santa Cruz	JUNAC Representatives, Lic. Charles Morin & Henri Flambert
March 19 a.m.	Santa Cruz	CORDECRUZ, Dpto. de Comercializacion Agropecuario, Lic. Guillermo Serrate
		Andean Cooperation Program to Bolivia (PCAB-JUNAC) Seminar on New Export Possibilities in Agroindustry
March 19 p.m.	Santa Cruz	Seminar continued
		Meeting with Jose Ribero, Consultant
March 20 a.m.	Cochabamba	Visit to INDESA, Plastics and Paper Plant, Miguel Pseiser, Mgr.
March 20 p.m.	Cochabamba	Meeting with Alfa-Laval representatives Sigfried Israel, Mgr. & Marcelo Rodriguez, Regional Representative
		Meeting with Mr. Gerald Fisher, USAID/PDAC Coordinator, Valles Altos

March 21 a.m.	Cochabamba	Visit to AGROQUIMICO facilities, UMSS, Ing. Luis Arteaga, Director
		Meeting with Mr. Edward Chadwick, Canadian Executive Services Organization (CESO) Volunteer
March 21 p.m.	Cochabamba	Meeting with Ing.Agr. Carlos Quiton, Manager of ASAR
		Team Meeting prior to departure of Dr. Jimenez
March 22 a.m.	Cochabamba	Visit to KORR plant, manufacturer of spices and herbs, Sr, Miguel Paniagua
March 23 a.m.	Cochabamba	Visit to the IBTA San Benito Experimental Station, Ing. Geraldo Salinas
March 23 p.m.	Cochbamba	Meeting with Ing. Leonidas Vega, Silicultural Consultant, DAI Valles Altos Team
		Meeting with Daniel Haggarty, President, Canadian Executive Service Organization and Rafael Otazo, Country Representative
March 24 a.m.	Cochabamba	Planning meeting for Country Market Study with Ney Lopez and Gustavo Navia, PDAC Marketing Specialist
March 24 p.m.	Cochabamba	National Market Study Terms of Reference Preparation
March 26 p.m.	Cochabamba	Visit to AGROQUIMICO, UMSS, Ing. Luis Arteaga, Director
March 26 p.m.	Cochabamba	Visit to ASOBOFLOR, Lic. Ivania Matta
March 27 a.m.	Cochabamba	Meeting with IBTA Chapare staff; Ing.Javier Guevara (Pina), Ing.Cesar Diaz (Cacao), Ing.Juan Lenis (Yuca)
March 28 a.m.	Cochabamba	CORDECO, Ing. German Ugarte, Dir. de Convenios Internacionales, Lic. Filomon Idiarte, Jefe de Division de Planificacion, Ing. scar Omonte, Tecnico, Div. de Planificacion
March 28 p.m.	Cochabamba	Meeting with Arturo Arze, Gen Mgr. Transcondor Europa (White Chocory production)
March 29 a.m.	Cochabamba	Meeting with Rodrigo Ortiz, Gen.Mgr., Programa de Promocion de Inversiones, CINDE, Costa Rica
March 29 p.m.	Cochabamba	Debriefing with Lic. Jose Decker, Director, PDAR

March 30 a.m.	La Paz	Meeting with Ing. Curtis Sittenfeld, Carana Corporation, Team Leader, USAID Export Promotion Project
March 30 p.m.	La Paz	Debriefing for USAID personnel, including Charles Hash, David Lozano, Bob Kramer, John Cloutier, Edmundo Ballivian

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