SURVEY OF OPPORTUNITIES FOR BOLIVIAN INDUSTRY

Volume I

Introduction and Summary

report to

THE MINISTRY OF PLANNING

BL
338.0984 Little (Arthur D.), Inc.
L778 Survey of Opportunities for Bolivian Industry. Jan 1971.
9 v.
In English and Spanish.

1.Industrialization - BL.2.Metal industries - BL.3. Electronic industries - BL.4.Chemical industries - BL.5.Forest products - BL.6.Food industry and trade - BL.7.Mineral industries - BL.I.Title.II.Consumer Goods and Light Industria roducts Sector.

Arthur D. Little, Inc.

RESERVADO

MINISTRY OF PLANNING

GOVERNMENT OF BOLIVIA

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SURVEY OF OPPORTUNITIES FOR BOLIVIAN INDUSTRY

VOLUME I

INTRODUCTION AND SUMMARY

JANUARY 1971

ARTHUR D. LITTLE, INC.

PRUDENCIO CLAROS Y ASOCIADOS

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I. OBJECTIVES, SCOPE AND BASIC ASSUMPTIONS

I. OBJECTIVES, SCOPE AND BASIC ASSUMPTIONS

A. INTRODUCTION

This volume is the first in a series of nine volumes each having the general title: Survey of Opportunities for Bolivian Industry. This Volume I is a SUMMARY of the other eight, which carry the following titles:

Volume II:	Non-Ferrous Metals Industry
Volume III:	Non-Metallic Minerals Industry
Volume IV:	Metal Working Industry
Volume V:	Electrical and Electronic Goods Industry
Volume VI:	Chemical Industry
Volume VII:	Forest Products Industry
Volume VIII:	Food Products Industry
Volume IX:	Consumer Goods and Light Industrial Products Industry

These nine volumes provide a full statement of the survey of industrial opportunities in Bolivia we have conducted. As part of the basic project we have also examined Bolivia's existing industry. The results of this work has been incorporated in three volumes:

Volumes I, II, III: Existing Industry in Bolivia: A survey of the current situation.

The ultimate objective of this survey is to recommend a program for the rationalization of Bolivia's existing industry which will enable it to take advantage of the opportunities offered by the implementation of the Andean Pact.

We have, as well, prepared a report on Bolivia's infrastructure and institutional framework. This study has been conducted in order to inform persons interested in, or responsible for, Bolivian industrial development of the infrastructural and institutional context within which new industries must be placed. More significantly, the report enables investigators to identify the infrastructural gaps that must be filled if the industrialization of Bolivia is to move forward on a sound basis.

B. OBJECTIVES

Our program of work has been designed and undertaken to assist the Government of Bolivia in the programming of the industrial development of the country, using the Andean Pact as one of the instruments for development. Our objective is to identify, within the eight industrial sectors indicated by the titles of the opportunity survey reports, those industries that deserve to be established in Bolivia. The identification process involves two, or in some instances, three steps. The first step is a survey to discover opportunities deserving further study. An intermediate step, which may not always be necessary comprises prefeasibility studies. The

final step consists of conducting feasibility studies of the industrial projects which have been tentatively selected for implementation. One of the purposes of these studies is to provide the evidence needed under Andean Pact procedures, to secure Bolivia an appropriate complement of manufacturing industries.

An additional objective, to be pursued by studies of existing industry, is to determine the steps that need to be taken to enable existing Bolivian industries to compete successfully in the Andean Market.

C. SCOPE

1. Opportunity Surveys.

The opportunity surveys covered eight industrial sectors, as follows:

Non-Ferrous Metals

Non-Metallic Minerals

Metal Working

Electrical-Electronic

Basic Chemicals

Forest Products

Food Products

Consumer Goods and Light Industrial Products

Opportunities were examined within the geographic context of the five nation Andean Subregion. We also considered the possibilities of exporting the products manufactured by these sectors to the Cuenca del Plata area, LAFTA and world markets.

2. Relationship to Other Studies.

An opportunity survey is the first of a number of investigative steps by which industrial projects that deserve implementation can be identified. Such a survey typically begins with a "universe" of possible industrial projects which are then screened and ranked by several criteria in order to identify possible projects which appear to be viable in terms of market size relative to minimum plant size, availability of raw materials and other inputs. The methodology we have used in conducting opportunity surveys is described in Chapter II.

a. Prefeasibility and Feasibility Studies

Opportunities are, thus, possible industrial projects which have been identified by a preliminary screening process and which then warrant further study in order to (1) identify the projects that deserve to be implemented and then (2) describe and confirm in full economic detail the projects selected for implementation. Generally, the first of these two purposes can be accomplished by what may be called a prefeasibility study while the second is effected by a feasibility study.

At times, the prefeasibility study stage is by-passed by incorporating both purposes into the feasibility study; moreover, on occasions an opportunity survey may identify some projects that are so clearly viable that there is no occasion for a prefeasibility investigation.

Under our present program of studies for Bolivia a prefeasibility study can also be used to gather the evidence needed to secure for Bolivia the reservation of a given industry.

b. Infrastructural and Institutional Framework Study.

Our program of opportunity surveys followed by prefeasibility and/or feasibility studies is supported by a study of Bolivian infrastructure and institutional framework. This study was conducted to provide the information required for the identification of viable opportunities and to identify in general terms inadequacies in Bolivia's infrastructure and institutional framework which currently or in the future will inhibit Bolivia's industrial development. It should be noted that no industrial opportunity has been rejected because of the absence of infrastructure and institutional framework or the high cost of these services, if their improvement appeared to be sound.

c. Studies of Existing Industry.

In addition to searching for viable new industries, we have also been conducting studies of existing industry in order to assess the impact of the Andean Common Market on the already established manufacturing enterprises in Bolivia. By the time that the second phase of the studies has been completed we shall have formulated recommendations as to the steps that must be taken by these industries in order to take maximum advantage of the Andean Pact.

In order to distinguish formally between opportunities for new industry (covered by the opportunity surveys) and the opportunities for additional sales by existing establishments (covered by the existing industry study) we drew a boundary between new industry and existing industry by regarding all additional investments in fixed assets as new industry. Thus, existing industry is being defined in terms of fixed manufacturing assets already in place and our analysis in the existing industry survey focused on finding more effective ways to utilize these assets. These ways can include different combinations of these assets with raw materials, labor, organizational structure and others.

D. BASIC ASSUMPTIONS

1. Bolivian Objectives.

The key foundation blocks for our research have been the assumptions made as to Bolivia's objectives in pursuing industrial development within the newly established Andean Common Market. We have inferred these objectives from our discussions with knowledgeable government officials and from careful study of pertinent documents, in particular the Government's "Strategy for Development".

These objectives are, briefly, to enlarge national real income, to raise the level of employment, to improve the Bolivian balance of international payments, and to achieve a diversified or balanced economy. A discussion of each of these four objectives follows.

a. Income Enlargement

We have assumed that Bolivia's primary and most important objective as the nation undertakes a program of industrialization within the Andean Pact is to enlarge real national income (or net national product). Bolivia's first economic concern is thus taken to be the raising of the level of living of the Bolivian people and industrialization is seen as a principal means of increasing the total of physical output and of improving the terms of trade (prices) at which Bolivia exchanges exports for imports.

The income of a nation can be enlarged by any of four processes, singly or in combination:

1) increasing the productive power of resources through capital investment in physical resources or investment in human resources (education, training, health) - this is the development process;

2) using resources more effectively through rational organization and management, the astute selection of goods to be produced, and the elimination of wastes and inefficiencies - this is a resource allocation matter;

3) using human resources more fully by putting in more labor time - this is usually a level of employment matter, but it also covers the number of hours worked by employees.

4) obtaining higher prices for exports and lower prices for imports through a variety of possible price-affecting arrangements coupled with appropriate selection of the goods to be traded - this is in terms of trade matter.

In searching for industrial opportunities and in examining the potentialities of existing industry, we have kept all of these income enlarging processes in mind.

Projects can potentially, increase incomes both directly - through additional income created (value added) within the project

itself - and indirectly - through additional income induced in activities outside the project. The indirect effects result partly from backward linkages whereby other industries expand production to supply goods and services to the project; there may also be forward linkages whereby users of projects output are thereby encouraged to expand. Indirect effects also include the income multiplier process which is the creation of additional demand through the repeated respendings of the increments to money income generated directly and by linkage effects.

In our evaluation attention is given to incomes generated, both directly and indirectly, by the projected industries that are being researched.

b. Employment Enlargement.

Considering the sizable unemployment or underemployment of the Bolivian labor force, it is to be expected that a second objective of the Government is to provide additional jobs through industrialization. In general this goal is entirely consistent with and complementary to the goal of enlarging national income, but occasionally the pursuit of one objective can be at odds with full pursuit of the other. A dilemma appears when total Bolivian incomes can be better increased through the installation of a capital intensive process in a plant while the employment goal would be better promoted by a labor intensive process. As in the

course of our further research we encounter instances in which pursuit of additional employment compromises the income enlargement objective, we shall report the options with due care.

While we have given substantial consideration to Bolivia's problems of unemployment and underemployment by giving due heed to labor intensivity in the ranking of projects, it is appropriate to stress that unemployment is a superficial problem and a nation should not make the fundamental error of distorting its economy in an attempt to ease the level of unemployment. As long as there are unsatisfied wants in a society there is no excuse for involuntary unemployment - no excuse except the rigidities, characteritic of almost every society, that prevent idle people and idle resources from being led into the production of the additional goods and services the nation would like to have.

Satisfactorily full employment is a short-term objective in the sense that a nation is determined to reach it as quickly as possible and once it is reached the nation is, or should be, no longer concerned to take action to try to raise employment levels. Moreover, once workably full employment is reached any continuation of policies designed to lift employment is likely to cause disruptive price inflation; thus, such policies and the instruments by which they are pursued need to be phased out as the unemployment problem is overcome.

c. Balance of Payments Improvement.

Many developing countries are beset by chronic balance of international payments difficulties as imports tend to exceed exports at going foreign exchange rates, thereby placing pressure on those rates and on foreign currency reserves. Governments in such situations ordinarily take as a development objective the adoption of projects that promise foreign exchange savings by producing substitutes for imports or goods for export.

As we have sought industrial opportunities for Bolivia we have recognized that the Government is concerned to ease balance of payments pressures and is interested in opportunities that are consistent with that objective. Accordingly we have taken the foreign exchange saving attributes of opportunities to be virtues. We have not, however, been able at the opportunity survey stage of our research to quantify the foreign exchange effects of any potential industry, thus we have not used foreign exchange flows as a criterion for the ranking of projects.

Two observations on the objective of balance-of-payments-improvement may be pertinent. First, this objective is like the employment objective in that it is attainable: a balance of payments problem can be corrected and once it is corrected the foreign exchange saving feature of any industry is no longer a virtue- it is a fault. Developing countries are not sufficiently wealthy,

ordinarily, to afford the luxury of exporting goods without being paid for them other than by the accumulation of reserves of foreign currencies; such a pattern would amount to the exportation of capital that is sorely needed at home.

A second observation is that foreign exchange pressures are frequently the symptom of a fundamentally overvalued currency, and when such is the situation the implementation of exchange saving projects will be inadequate - the appropriate remedy is a devaluation.

d. Diversification.

Bolivia in addition to wanting higher incomes, more jobs, and foreign exchange savings, evidently hopes through industrialization to achieve a more diversified (i.e. a more self sufficient) economy. Diversification may need to be named as a separate goal because if Bolivia were to concentrate entirely on the first three goals the nation could be led into producing principally raw materials, agricultural and mineral, for export, almost to the total neglect of industry. Bolivia appears prepared, as are most other nations, to forego some of the benefits of thorough going comparative advantage in favor of a more balanced or diversified economy. Such a Bolivian economy would produce a variety of manufactured goods as well as raw materials, providing the nation a medium of economic independence from the outside world and

assuring Bolivians a full panoply of productive outlets for the range of talents, developed and latent, possessed by the Bolivian people.

It is likely also that diversification can be made to contribute to terms of trade improvement because the bargaining strength needed to push prices in favorable directions can be marshalled only as the variety of domestic activity provides markets or sources of supply alternative to those in the outside world. Diversification, thus, provides a degree of economic independence such that the nation feels less at the mercy of powers and events in the rest of the world.

2. Industrialization Objectives of the Andean Common Market.

Although much has been said and written about the industrialization goals of the Andean Subregion and the processes by which they are reached, it is evident that assumptions that could serve as guidelines to our own research are still in the process of formulation by Andean Pact authorities and representatives of the member governments. It may nevertheless be useful for us to indicate such assumptions as they may be implied by the approach we have taken in preparing our reports.

a. Industrial Development by the Andean Subregion as a Limit.

We have assumed that in endeavoring to achieve a common market in industrial goods and integration of the manufacturing, it is

appropriate to regard the Andean Pact's objectives for the region as a whole to be much like those of any one of its nation members, such as Bolivia. We have then assumed goals of income and employment enlargement, of balance of payments improvement for the Andean Subregion as a unit in its reactions with the outside world, and of a sufficiently broad range of industrial activities to achieve a diversified economy for the subregion as a whole.

Our research was started at a time when no decisions had been taken by the Andean Pact authorities as to the identity of the industries to be developed within the five-nation region. Moreover, decisions had not been made about the level of protection or subsidy that might be accorded new manufacturing industries within the Andean Subregion. Thus, our frame of reference was necessarily incomplete.

Under these circumstances the universe of possible industries from which Bolivia might conceivably choose has been comprehensive. For our purposes it has included all the industrial categories contained in the terms of reference given us in February 1970, plus additional products within each sector which during the course of the study appeared to be opportunities.

b. Geographic Distribution of Industry in Andean.

We understand that one of the objectives of the Andean Common Market is to raise real production throughout the region as each

member nation concentrates on those lines of production in which it has a comparative advantage. "Comparative advantage" is the capability of a nation or other geographic entity under conditions of equilibrium to produce (and, usually, to export) a given good more cheaply in terms of money than any other nation. If the good is produced more cheaply in real terms, e.g., in man hours, in that area than anywhere else, the area is said to enjoy not merely comparative advantage but "absolute" advantage as well.

By definition every nation has, under internationally equilibrious conditions, comparative advantage in sufficient lines of production to enable it to pay through export earnings for all that it tends to import at going rates of foreign exchange. Moreover, apart from questions of non-competitive international pricing, a nation as a whole can enjoy higher real incomes under a pattern of economic activity based on comparative advantage than under any other pattern.

Accordingly, it might be anticipated that the Andean Subregion as a group might take as an objective the geographic distribution of economic activity in the five nations strictly in accord with the principle of comparative advantage. This possible objective is being adopted, however, only in a severely qualified way. In the absence of unrestricted migration of people between and among the five nations, the distribution of activity in conformance with comparative advantage might allow

significant differences in real per capita income from one nation to another. Moreover, such a distribution might concentrate manufacturing activities in relatively few locations, leaving some members, particularly Bolivia, almost bereft of industry.

The authors and executives of the Andean Pact evidently (1) have recognized that each of the member countries desires to have a proportionate share of the industrial expansion that is expected to take place in the Andean subregion in consequence of the Pact and (2) have indicated that new industries should be distributed through the Andean Subregion in accordance with the principle of comparative advantage. In the light of the comments we have just made, it might appear that these two guidelines are in conflict. However, we have effected a reconciliation of the two principles by thinking of new industry being so apportioned geographically that each country tends to export to the rest of the Andean Countries sufficient products from its expanded industrial sector to pay for the incremental industrial imports from its Andean neighbors. This pattern would be consistent with regarding the industrial sector of the five nations combined as constituting, within itself, an international economy within which the principle of comparative advantage can be applied.

By taking this approach we have been able to envisage a Bolivian economy that would tend to be self-supporting industrially in the sense that the enlargements of manufactured imports associated with growing Bolivian incomes would be matched by enlargements

of Bolivia's exports of manufactured goods.

3. Practical Considerations.

In addition to the formal assumptions that we have made respecting (a) Bolivian objectives within the context of the Andean Pact and (b) the objectives of the Andean Subregion as a five-nation group, we have adopted a number of practical guidelines affording our approach to each of the possible opportunities that have been surveyed. Five of these guidelines are sufficiently basic to be explained in this chapter; the others, which are more procedural, are described in Chapter II.

a. Avoidance of Limitations of Micro-Economic Approach.

In formulating a set of guidelines appropriate to our program of studies we were keenly aware that it would be unwise to consider each possible project only as an isolated undertaking in the Bolivian national economy as it now exists. Such an assumption - which would mean taking a micro-economic analytical approach to Bolivian development - would cause the discard of the many Bolivian projects which can be viable once one or more infrastructural gaps are filled. For example, if the transport system and its existing rates are taken as given, many projects can appear non-viable because of the high cost or non-existence of adequate transport.

In short, a ceteris paribus assumption that the entire economy remains unchanged except for the project under consideration would effectively block Bolivian development because many projects - perhaps most projects - appear viable only as it is assumed that certain other projects, particularly infrastructural projects, are undertaken first. Moreover, if this micro-economic assumption were taken while infrastructural projects were being examined, many of them might remain unimplemented because the current demand for their services appears inadequate.

To avoid this frustrating difficulty either (a) a broad range of projects, both infrastructural and structural, needs to be examined simultaneously or (b) each individual project needs to be examined on the assumption that the needed infrastructure and other externalities will be provided. We have used the former approach within each sector and the latter approach in considering each project vis-a-vis needed services or input goods or markets outside the project's own sector.

For example, no project has been rejected on the ground of inadequate transport, and no agriculture-based industry has been dropped on the ground that the agricultural products which are the raw materials of the industry are not now being grown. We have not, of course, assumed that any project should be implemented before the needed infrastructure and other externalities are also brought into existence; rather, by showing the industries that

can be established once transport exists or is made cheaper we take an affirmative posture that fosters the growth of transport by indicating what may need to be carried once the transport link is provided.

When considering potential opportunities the implementation of which would depend upon Bolivian raw materials, we assumed that the production of those materials, whether agricultural or mineral, could be increased in quantity as needed to supply Bolivian manufacturers. The realization of this assumption is, of course, crucial to the development of food processing industries such as meat and vegetable oils and of mineral-using industries such as the production of tungsten carbide and non-ferrous alloys.

We assumed - and this assumption is considered further below - that any infrastructural deficiencies that might interfere with the success of an industry would be overcome.

b. Prices, and Financial Performance.

We assumed that the prices of raw materials, supplies, and equipment would be no higher than now; this is a hazardous assumption because many material inputs for industry are likely to become more expensive once they are produced within the Andean Subregion rather than purchased from the outside world. The assumption was nevertheless appropriate because our objective

was to discover all affirmative possibilities. A similar assumption was to take selling prices as they now stand in the principal market locations within the Andean countries. This assumption might be regarded as unwarranted because prices will adjust as duties on goods from outside Ancom are changed to conform to new common external tariff schedules. We believe that it is an appropriate assumption, however, because the levels of the common tariff may be close to the average of those that prevail today.

We did not reject any possibility on the grounds that commercial costs would exceed commercial revenues unless the excess was so large that we could not imagine its being countenanced by Bolivian or Ancom authorities. If, however, the excess was far larger than that expected for producers in a more favored Andean nation, the possibility was typically discarded.

c. Measurement of National Benefits and Costs.

Benefits/costs analysis is a method of measuring the national income effects of a project. Essentially the method calls first for noting the values expected to be produced in a project - these values being the gross benefits; then, recognizing that the human and material resources required for the project must be transferred out of their present activities, the values presently being produced and which will need to be foregone as the project

is implemented are measured - these are the costs of the project. Gross benefits minus costs equal the net benefits, these being the increment to real national income to be anticipated from the project.

Benefits/costs measurements are typically made by modifying the revenue and expense data that are prepared to permit project evaluation from the viewpoint of the entrepreneur or investor. Revenue data may be converted to gross benefits by making adjustments for taxes or subsidies; expense data may be converted to costs by noting any differences between payments to resources in the project and level of payments in existing (pre-project) activities.

During an opportunity survey there is no occasion to try to measure national economic benefits and costs. The subject is mentioned here because it indicates the general approach or attitude we are taking throughout the whole program of identifying opportunities and evaluating their feasibility. The most feasible industrial projects from a Bolivian national economic standpoint are taken to be those that contribute the most to real national income as shown by the difference between gross benefits and costs.

d. Locale of Markets.

It should be noted that although the occasion for these opportunity surveys has been the prospective unrestricted access

for Bolivian industrial goods to the markets of Chile, Peru, Ecuador and Colombia, we have as part of our investigations looked at opportunities to manufacture goods for sale in Bolivia and for export to neighboring countries like Brazil, Paraguay, and Argentina as well as world markets within the rest of LAFTA and overseas.

e. Use of NABALALC Code.

The process by which the five member nations form themselves into a common market, that being one of the chief purposes of the Pact, is one of adjusting customs duties on traded commodities classified according to the NABALALC code, which is an elaboration of the Brussels Tariff Nomenclature. The members subscribing to the Andean Pact have decided to use the code also for the purpose of classifying types of industrial activity in the region. Such usage is convenient in that it permits ready linkage of tariff adjustment on given commodities to decisions respecting the production of the same commodities within the Andean Subregion. We have been forced to notice, however - as have, no doubt, the Andean Pact authorities who made the decision to use the code for delineating industries - that the NABALALC code classifies commodities, not types of economic activity; the code is in this respect similar to the Standard International Trade Classification (SITC) and thus different from the International Standard Industrial Classification of All Economic Activities (SIC) which is designed for delineating industries. The NABALALC code is

inconvenient for handling industries in that a given industry may produce commodities from several four-digit code categories and the goods in any one category may typically be produced in two or more distinct industries. We have, fortunately, found ways to combine code categories, using at times seven - or eight - digit classifications, in order to delineate industrial opportunities satisfactorily.

II. ANALYTICAL APPROACH

II. ANALYTICAL APPROACH

Our research methodology - the analytical procedures by which opportunities were identified and ranked - was essentially the same for all eight sectors. In applying this methodology, however, differences in emphasis and sequence between sectors were found advisable.

A. IDENTIFICATION OF OPPORTUNITIES

We will first describe the model or standard procedure for project identification and then note the kinds of variations that became advisable as the model was applied in each of the eight sectors.

Generally the approach was to test each possible opportunity in terms of:

- the size-adequacy of the market the Bolivian manufacturer might be in a position to serve, this size-adequacy being relative to
- the minimum size plant that might be economically sensible for producing the goods, and
- the availability of the needed raw materials, with particular attention to their availability as Bolivian produced materials.

1. Standard Approach

As long as a Bolivian producer's prospective share of a market now supplied from outside the Andean subregion looked to be larger than the output of a minimum size plant and aslong as the producer's access to raw materials and other inputs looked to be roughly as good as that of potential competitors in other Andean countries, a possibility was termed an opportunity and the research task then became one of comparing it to other opportunities.

Before attention is given to the method of ranking of opportunities more can be said about the identification process.

a. Market Size

Our investigations of market size were generally studies of official import statistics supplemented by interviews with informed public officials, importers, large users and manufacturers of the product in Bolivia, other Andean countries, the rest of LAFTA, and overseas, etc. Our classification of goods was regularly that of the import statistics, usually the NABALALC code carried to four digits. Very little accuracy was forfeited by generally considering four digit product groups since to treat individual product manufacture would be reaching for greater precision than other factors such as the accuracy of available market data would justify. Moreover,

to study products individually would depart from reality, since manufacturing economics dictates that products utilizing the same technology and equipment should be included under one manufacturing roof. Nevertheless, on numerous occasions we departed from this criterion and considered items having more than four NABALALC digits when their manufacture could be viewed as project by itself.

For most goods the potential market was taken to be the sum of imports into Bolivian and into the other four Andean countries plus imports into three of the four Cuenca del Plata coutries - Paraguay, Brazil, and Argentina[1]. In those instances, however, where products would need to depend upon broader (i.e. world or other LAFTA) markets, these were also analyzed.

Categories of goods, imports of which into Bolivia and into other Andean countries were too small to be attactive, were dropped, at least tentatively, from further consideration. The usual minima were US$ 50,000 to US$ 100,000 yearly into Bolivian and US$ 500,000 to US$ 1,000,000 into the Andean subregion. Within these ranges, the exact level of imports used as a criteria for elimination depended on the industry.

These minima were selected considering that:

- In almost any manufacturingindustry the minimum scale of plant would require annual sales of at least US$ 50.000

1. Data on imports were not available for Uruguay

to US$ 100.000.

- Bolivian manufacturers would not be capable of achieving 100% market penetration in the Andean subregion as a result of domestic competition and, as a result, for the project to have a reasonable possibility of success the market for a product would need to be about US$ 500,000 to US$ 1,000,000.

b. Minimum Size Plant

Once the list of possible industries was reduced by this market screening divice, minimum plant size were noted for each and possibilities were retained if the prospective sales of the enterprise were sufficient to allow the minimum plant to operate at its break-even level or better.

c. Raw Material Availability

The availability of raw materials was checked in order to be assured that a Bolivian plant would not be highly disadvantaged as against its competitors in the other four countries.

The three-step screening process was first carried through on the basis of four-digit categories or of finer categories if all items within a four-digit category would not or need not be produced in the same plant. Then the screening process was repeated using combinations of categories insofar as the goods might be manufactured more economically by producing them together in a complex. A number of viable combinations were discovered by this procedure.

2. Modifications

The standard approach we have discribed was modified to accommodate the relevant differences among sectors or industries.

For example, a number of potential Bolivian manufactures, particularly products of non-ferrous minerals, command only small markets within the Andean Group. Their viability depends upon their being sold successfully in world markets. Similarly certain precious woods and products like pyrethrum and chinchona would depend on world outlets. Accordingly such products were not selected by reference to the size of the Bolivian and other Ancom markets.

As a second example, some industries in the food products sector can produce economically in plants of such small scale that plant size was not a screening device.

B. RANKING OF OPPORTUNITIES

1. Criteria

Once a potential opportunity passed these three test-market, minimum scale of plants, and raw material availability - it was deemed an opportunity. The opportunities in each sector were then ranked according to some eight criteria. These were as follows:

a) Market size (compared to minimum plant)

b) Market trend

c) Existing (and prospective) Ancom production

d) Backward linkage, including use of Bolivian raw materials

e) Forward linkage

f) Labor intensiveness

g) Ratio of value to weight or bulk

h) Time to implement.

Each of these criteria can now be considered in turn.

a. Market Size

Generally it was appropriate to compare the size of the market with the volume of sales needed to render a minimum plant viable. The higher the ratio of the first to the second, the higher the ranking of the opportunity.

b. Market Trend

Where available data were sufficient to permit tenable market forecasts, projections were made. But even when the prospective market could not be usefully quantified we were able most times to discern the direction of market trends. The more sharply upward the trend, the higher the ranking of the opportunity.

c. Existing (and Prospective) Andean Production

For each Andean country we endeavored to quantify local production of the goods involved in each opportunity. This quantity was then compared to the import quantity for the same good. The longer the local production in the other four Andean countries as a share of total consumption in those countries, the less the likelihood that Bolivian producers could build sizable sales in those markets and, accordingly, the lower the ranking of the opportunity.

d. Backward Linkage

Backward linkage refers to the tendency of an industry to patronize local producers and thereby encourage an expansion of their operations. Considering the generally low levels of employment and resource development in Bolivia, such backward linkage is an important consideration. The use of Bolivian

agricultural and mineral raw materials is a particular kind of backward linkage and such use occasions the upward ranking of a project even when the raw materials would be produced in any event and sold abroad in their raw state if the opportunity were not implemented.

e. Forward Linkage

Forward linkage is counterpart to backward linkage. It is the effect of new industry output on other Bolivian industry. Thus insofar as the implementation of an opportunity means the provision of goods to other existing or prospective industry, a forward linkage that encourages further industrial expansion exists and justifies a higher ranking for the opportunity. Opportunities to produce consumer goods do not carry any forward linkage; this fact does not mean that consumer goods industries are less desirable than other industries, because consumer goods production can show greater backward linkage than other industries.

It can be said that the degree of linkage, backward or forward, is a function of the delineation of the opportunity. If an opportunity is formulated as a fully integrated industry which produces its own raw materials and sells its final products to consumers, there is no rrom for any linkage except in the production of equipment and some supplies or services. But an integrated project is certainly no less desirable

because of the absence of linkage. What matters, of course, is the net value added within the national economy consequent to the implementation of the project; in other words, a project's economic value to a nation is primarily the net addition to national income or product that it can cause. The degree to which the addition takes place within the project vs. outside it is a matter of no consequence.

f. Labor Intensiveness

The matter of labor intendiveness is remarkably similar to backward linkage. Both concepts deal with a project's use of local resource, but in the instance of labor intensiveness our concern is the amount of labor/time embodied in a given quantity of output. The more labor intensive a project the more use it makes of relatively unskilled labor as against other inputs, domestic or foreign. Understandably, a nation like Bolivia with a reservoir of unemployed or underemployed untrained labor attaches significant importance to labor intensive projects and we have accorded such projects higher ranking.

While raising employment levels in Bolivia is certainly an urgent matter - economically, sociologically, and politically - it must be kept in mind as long-term policy decisions are taken that a resource committed to one activity is not available for another. Once the Bolivian economy is in good working order there will be employment for the entire labor force; at that point

the principal concern of the nation can be to make certain that its labor force is employed as productively as possible. High productivity will then call for capital intensive, not labor intensive, manufacturing methods.

g. Ratio of Value to Weight or to Bulk

Bolivia because of its location and its topography is at a transport disadvantage, for most manufactured products, when competing in export markets or when using imported raw materials. To take this factor into account we computed the value to weight relationship for the products and raw materials involved in each opportunity. Higher ranking was given to opportunities, the materials and products of which carried higher value to weight ratios and would be, therefore, capable of absorbing relatively high transport costs.

h. Time to Implement

The industrial development of Bolivia is an urgent matter, thus the more quickly a project can be in production after the decision is taken to implement it, the better the project. Thus we estimated for each project the amount of time needed to implement it, and awarded higher rankings to those carrying short implementation periods. The definition of "implementation" is quite flexible since projects of operating on a garage-scale with three or four employees can be put into operation virtually

overnight. The "time to implement" is the time required to make plans, order equipment, construct buildings, receive equipment, find and train people, and manufacture the first batch or products. The operation may or may not reach the break-even point within the time indicated. On the other hand, an entrepreneur with hard work and good luck might achieve profitable status very quickly.

2. Degrees of Promise

Following the ranking by these eight criteria, the various opportunities in each sector were grouped. In some sectors three groups were appropriate - high promise, medium promise, and low promise. In other sectors it was advisible to add a fourth group - minimum promise; an opportunity of minimum promise is a marginal industry which does not deserve further study unless there is a significant improvement in one of the attributes that contributed to the low ranking.

Generally high promise opportunities have been described in far greater detail than have those of medium and low promise.

C. COMPLEXES

A third analitical step was to reexamine the full array of opportunities in each sector to discern possibilities for combinations or complexes including products from two or more four-digit categories. Such complexes can incorporate commodities

the production of which might not be economical if each commodity were to be produced in a separate plant; moreover, even when each comodity constitutes a separate opportunity, combinations can provide worthwhile manufacturing economies. We discovered a number of possible complexes that deserve to be treated as opportunities.

D. TYPES OF RECOMMENDATIONS

Generally we recommend that each of the opportunities that shows high promise or medium promise be investigated further, either by prefesibility study or by feasibility study. If the opportunity survey shows clearly that a given category of products can and should be manufactured in Bolivia, we recommend that a full feasibility study be conducted as the next step. If, on the other hand, it is not certain that a viable project can be designed within the area identified as an opportunity, we recommend a prefeasibility study as the next step.

A prefeasibility study, in contrast with a feasibility study, is particularly appropriate when there are still unresolved questions about, say, the quality or the quantitative adequacy of raw materials, or about changing market patterns. Such questions can provide the focus of a prefeasibility study; once they are satisfactorily answered, the remainder of the inquiries needed to provide a full feasibility study can be instituted.

At the time the several opportunity survey reports were finalized it was not known which of the categories named as high or medium promise opportunities might be selected by the Ancom authorities for assignment to one or more number countries. Thus the possible use of prefeasibility studies to provide evidence to the Ancom authorities was not incorporated into our recommendations. It may be sufficient here to state that we believe that high and medium promise opportunities which are to be assigned under the provisions of the Andean Pact should be next subjected to prefeasibility study in order to demonstrate to everyone involved in the assignment decision process that such opportunities deserve to be implemented and that they shoud be sited in Bolivia. Then, once the Ancom authorities have concurred by assigning projects to Bolivia, the remaining investigations needed to provide a full feasibility study can be performed.

III. CONCLUSIONS

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A. NON-FERROUS METALS

Our analysis of Bolivia's non-ferrous metal resorces indicates that tin, bismuth, zinc, lead, copper, antimony and tungsten have reserves in sufficient quantity and quality to be exploitable (table 1). Other minerals are also available but their quantity is unknown. It is probable that as more exploration is conducted the quantity of reserves will increase.

Our study has indicated that it would be to Bolivia's benefit to convert as much of the minerals currently exported as concentrates into metals. Table 2 presents for tin, zinc, antimony, bismuth, and tungsten the value added if Bolivia were to convert its concentrates into metals. It clearly illustrates the benefits derived from upgrading. If Bolivia had sold 1969 production of these minerals in metal rather than in concentrate from it would have earned an additional US$ 23.8 million.

We have classified opportunities in the non-ferrous sector into four categories as follows:

- Upgrading of Tungsten, Copper and Zinc;
- Production of ferro-alloys and non-ferro-alloys;
- Exploration;
- Maketing.

TABLE 1

BOLIVIAN RESERVES OF NON - FERROUS MINERALS

PROVEN, INDICATED AND INTERFERRED

(In Tons)

Mineral	Proved and Indicated	Inferred
Tin	1,083,428	350,600
Bismuth	13,200	2,000
Zinc	1,210,000	2,000,000
Lead	232,000	495,000
Copper	311,000	500,000
Antimony	145,000	50,000
Tungsten	57,700	100,000

TABLE 2

VALUE ADDED BY CONVERSION TO METAL

Metal	Sales Value Per Ton of Metal Content of Ore		Sales Value Added by Conversion to Metal	1969 Output (Long Tons)[2]	Gross Sales Value Ore (US$)	Gross Sales Value Added by Conversion to Metal (US$)
Tin	3,240	+	120	29,900	96,480,000	3,840,000
Zinc	228	+	72	26,300	6,000,000	1,896,000
Copper	900	+	-	8,000	7,200,000	864,000
Antimony	960	+	108	12,300	11,760,000	1,776,000
Bismuth	6,960	+	2,640	600	4,176,000	1,584,000
Tungsten	6,000	+	6,000[1]	2,300	13,800,000	13,800,000

1. Hydrogen Reduced Power

2. One Metric Ton = 0.98 Long Ton

1. Upgrading of Tungsten, Copper, and Zinc

a. Tungsten

Bolivia, as a very important factor in world tungsten production and reserves and in view of a very strong world demand, is in a position to upgrade its tungsten concentrates to much higher value products. World consumption of tungsten has been growing at a rate of 4% per year but in the next several years it should increase at a rate of 5-10%.

Our analysis has indicated that there is a very promising opportunity to upgrade concentrates by processing to at least refined tungsten oxide (WO_3) which would yield an increment of 33% in value over that of concentrates. More important there may be an opportunity to produce ferro tungsten (about a 50% increase in value) or ideally hydrogen reduced powder (100% increase in value). In addition, there are opportunities for upgrading significant amounts of Bolivian tungsten to carbide powder which has a value two-and one-half times that of concentrates and lesser amounts to sintered carbide blanks which have a value four times greater than concentrates and finally to tools with a value over ten times greater than concentrates.

It is also possible that the hydrogen reduced powder could be sintered and swaged into mill products with values ten to thirty times greater than concentrates. However, mill products

use relatively small amounts of the total tungsten produced (about 25% of total consumption) and the investment required for their production may be not justified.

The most logical approach towards upgrading tungsten would be to focus on sintered tungsten carbide blanks and tool and the intermediate products which include refined tungsten oxide, hydrogen reduced powder, and tungsten carbide powder. These are the major volume products, accounting for 40% of end use as compared to 25% for mill products and 11% for ferro-tungsten. The remainder of tungsten is accounted for miscellaneous uses such as sheelite and wolframite concentrates which are added directly to steel for alloying and carbon reduced powder used for ferrous and non-ferrous alloys.

The investment required for facilities to upgrade tungsten to carbides and tools would be in the range of US$ 6.0 million, depending on the volume of tungsten concentrates treated and the likely proportion processed to tools.

In summary our analysis has indicated that the upgrading of tungsten concentrates represents an outstanding opportunity for Bolivia.

b. Copper

In comparison to Perú and Chile, Bolivia is a very small

producer of copper. In recent years Bolivian yearly production of concentrates has been about 8,000 tons as against 650,000 tons by Chile and 200,000 tons by Perú.

At this time Bolivia does not produce sufficient concentrates to justify the establishment of a copper smelter whose minimum economic scale of plant is about 30,000-50,000 tons of blister copper per year. A very promissing opportunity, however, exists for increasing reserves through an incerase in exploration effort. After additional reserves have been found Bolivia should consider the installation of a smelter.

A small interim opportunity exists for the production of copper and copper alloys. The copper produced would be used to supply the domestic market; the copper alloys would be a part of a non-ferrous alloy complex. About 10% of the copper in concentrates presently produced in Bolivia is in the form of native (uncombined) copper which could be separated by flotation at the present mills. Native copper which is nearly the equivalent of scrap, could be melted and fire refined to produce copper metal of adequate quality for the production of alloys such as bronze and brass.

It would not be suitable for electrical use. As the production of concentrates increases and additional amounts of native copper are separated, a small electrolytic refinery producing 1,000 tons to 3,000 tons per year would probably be

justified. This refinery would convert the fire refined native copper to electrical grade copper.

There is also a potential opportunity to recover copper from oxidic copper ores. Most copper ore bodies that outcrop have oxide copper zones at the surface above the massive sulfides. These oxidized ores cannot be concentrated by physical-chemical benefication methods such as flotation but instead must be leached with sulfuric acid and the copper recovered by electro-winning the metal from the copper sulfate solution. Electro-winning copper from the solutions will result in high purity copper suitable for electrical use.

c. Zinc

Bolivia currently produces about 26,000 tons annually of zinc concentrate. The reserves of zinc are estimated at 1,210,000 tons, proven and indicated, with an additional 2.0 million tons inferred. We estimate that Bolivian zinc reserves are sufficient to support the present level of mining operations for about 40 years.

The construction of an electro-wining plant to produce zinc metal in Bolivia is in the planning stage. Although zinc smelters in other producing contries have in recent years experienced losses, our analysis has indicated that the world market outlook for zinc is promising and that a Bolivian smelter would benefit

from an improved market. The production of electrolytic zinc in Bolivia should also generate opportunities for die casting and galvanizing, which are the major uses of zinc metal.

2. Production of Ferro-Alloys and Non-Ferrous Alloys

a. Ferro-Alloys

The high volume ferro-alloys are ferro-manganese, ferro-silicon and by product silico-manganese; ferro-chrome and ferro-nickel are also important. Ferro-alloys of molybdenum, titanum, tungsten, vanadium and columbium are produced in much smaller quantities.

Bolivia has known resources for the production of ferro-tungsten and ferro-silicon. Potential resources for the production of ferro-manganese are also known to exist in Bolivia. However, the manganese to iron ratio may not be sufficiently high to produce all the commercial grades of ferro-manganese. Bolivia also has showings of nickel, molybdenum and titanium and a possibility of vanadium associated with uranium. If commercially exploitable quantities of these minerals are found in Bolivia ferro-alloys could also be produced from them.

In the Andean Subregion Chile is the only producer and net exporter of ferro-alloys. The Andean market imports approximately 4,000 tons to 5,000 tons of ferro-alloys per year.

In other South American countries Brazil and Argentina produce ferro-alloys; of the two only Brazil produces a full range of ferro-alloys.

This analysis indicates that an opportunity exists for Bolivia to produce ferro-alloys to export to the Andean markets and also to selected South American countries. The opportunity for Bolivia would probably be in some of the high value ferro-alloys, particularly those where the raw material is a large part of the value of the end product and where the ferro-alloy metal would be available in Bolivia. Examples of these may be ferro-tungsten, ferro-manganese and possibly ferro-nickel, ferro-molybdenum and ferro-vanadium. The production of alloys such as ferro-silicon do not represent promising opportunity since the cost of the raw materials (i.e sand and iron ore) are a small proportion of the total cost. It may be necessary, however, to produce ferro-silicon in order to provide a line of ferro-alloys.

A small 5,000 ton to 6,000 ton ferro-alloy plant would require a capital investment of about US$ 1.5 million for the plant facilities. A ferro-alloy plant is normally easily expandible by adding furnaces individually. As a result a small plant could be installed initially and subsequently expanded as demand for the product rises.

The profitability of a small ferro-alloy plant would be marginal if it produced only the high volume, low value (US$ 140 - US$ 275 per ton) ferro-alloys such as ferro-silicon and ferro-manganese . unless power costs were very low (i.e. in the range of 5-9 mills per kwh). On the other hand, if high value ferro-alloys based on Bolivian raw materials were produced such as ferro-tungsten the facilities would be very profitable.

In summary the production of ferro-alloys in Bolivia represents a very attractive opportunity. Its viability however, would depend on the market for specific ferro-alloys and on the availability in Bolivia high value raw materials. With the exception of tungsten, there is no significant loss in the value of metals such as manganese, nickel vanadium or titanium if they are converted to ferro-alloys instead of to pure metals. Since tungsten can be easily upgraded to powdered metal and carbide, the best approach would be to convert a portion of tungsten to ferro-tungsten but only if it represented one of a number of ferro-alloys produced. The installation of a ferro-alloy plant to produce only ferro-tungsten would not represent the most attractive alternative.

b. Non-Ferrous Alloys

The variety of non-ferrous metals available in Bolivia suggests the possibility of producing a broad range of non-ferrous alloys such as a wide variety of solders, bronzes (both tin and

phosphor), tin and lead Babbits, white metal alloys, low melting alloys (bismuth), tin-copper, zinc, cadmium, nickel, and lead electroplating alloys and pewter. The viability of this project would depend on the market.

Accurate statistics on the market for non-ferrous alloys are difficult to obtain. Our analysis however, has indicated that the market in the Andean Subregion is in the order of US$ 1.0 million per year and in the LAFTA area US$ 4.0 million per year. These market figures are subject to confirmation. It is probable that Bolivia could supply part of the Andean market, although Perú produces many of the same metals which are basic to non-ferrous alloy production.

The World market for non-ferrous alloys is large relative to the Andean and LAFTA markets. To enter World markets, however, would involve replacing traditional supplies which may be difficult. The tin and bismuth based (high value) alloys would have better possibilities to penetrate the World market than lower value lead and copper alloys.

The availability of tin metal, silver, antimony, zinc, lead metal, and bismuth places Bolivia in a very favorable position to produce non-ferrous alloys. While other countries produce many of these metals, very few produce both tin and bismuth which are the basis for the high value non-ferrous

alloys. Another factor which should be taken into consideration is that a certain volume of by-product mixture of metals will be produced at the Klockner smelter which will either have to be refined or converted to useful alloys by appropriate primary metal additions. Refining of these mixtures would probably have to be conducted in Europe and, therefore, the by-product value would be low. A better alternative would be to utilize the products in alloy manufacture.

The old Metabol or Peró smelter with additonal capital investment could probably produce non-ferrous alloys.

3. Exploration

Our analysis has indicated that large opportunities exist for Bolivia to increase and hopefully discover higher grade reserves and place deposits of tin through intensified exploration. Similarly we are optimistic that a well planned exploration program would have a good probability of finding additional reserves of copper, antimony and bismuth and perhaps nickel, molybdenum (often associated with copper), vanadium (often found with uranium) and rutile.

Uranium exploration is of particular interest since demand is expected to increase by 500% over the next ten years. Present consumption is 11,000 tons per year of U_3O_8 and it is forecasted to increase to 63,600 tons by 1980; the accumulative demand during

the 1970-1980 period is expected to be 363,600 tons. World reserves are currently about 763,600 tons of U_3O_8, adequate for only about 15 years.

4. Marketing

Government controlled Bolivian organizations have had experience marketing concentrates but not in marketing metals. In the near future as smelting capacity is installed Bolivia will be marketing tin, bismuth, antimony metal and oxide, zinc, and perhaps tungsten. Tin, lead and zinc are relatively easy to market since they are sold on the London Metal Exchange common pricing basis. The significance of this is that any new or occasional supplier can expect to obtain the same price as a traditional supplier. This is not the case for antimony, tungsten, and bismuth nor would it be true for non-ferrous alloys. The market for these metals has been traditionally supplied by a limited number of producers who have established over a long-period of time close customer links and who compete more on service, quality, and product variation than on price. They recognize a mutual self interest to maintain a common and stable pricing policy. In other words, they recognize price leadership by one or two companies and stockpile material, or very occasionally ration it, as necessary, giving only limited discounts from a recognized and consistent world price, as indicated by the supply demand balance.

In the late 1950's and 1960's, a number of new suppliers of antimony entered the market who, for various reasons, were either uninterested or unable to establish permanet relationships with customers. As a result, these companies offered metal purely on a price basis, obtaining for their antimony metal whatever price was available at the time; this was a "free market". On most occasions this meant selling the metal at a substantial discount from the existing producer price. On very few occasions did they receive a price near the producer price and only in 1969 was the price at which the antimony metal was sold above the producer price.

In the case of bismuth a free market has been reported by the Metal Bulletin of London as of January, 1969, although the market probaly existed two or three years before this date. Such a market does not presently exist in tungsten but should Bolivia begin to produce and sell an upgraded product such as hydrogen reduced powder or tungsten carbide, this will create a free market, unless permanent customer contacts are established.

Our experience indicates that free market price has generally been 20% to 30% below the producer price (except in bismuth). In practice, the discount has probably been closer to 15% since, as mentioned earlier, producers do in fact discount prices to their better customers during periods

when the market is soft. This would not be reported in the Metal Bulletin. It is reasonable to assume that a similar discount would develop in tungsten if there were spot suppliers.

Table 3 indicates the effect on Bolivian revenues from free market discounts for Antimony, Bismuth, and Tungsten. Assuming that Bolivia sells 6,000 tons of antimony, 400 tons of bismuth and 2,000 tons of tungsten, the loss in revenues would be US$ 5.1 million if the discount is 15%, US$ 3.4 million if the discount is 10% and US$ 2.6 million if the discount is 7.1/2%.

B. NON-METALLIC MINERALS

Our analysis of resources, markets, and minimum economic scale of plant and technology indicated the following opportunities.

1) Construction Materials
2) Glass
3) Ceramic Tile
4) Magnesite Grain
5) Asbestos
6) Vitreous Plumbing

Other non-metallic minerals and their derivative products were eliminated from further consideration for a number of

TABLE 3

LOSS IN BOLIVIAN REVENUES DUE TO FREE MARKET DISCOUNTS

Metal	Volume of Metal Long Tons	Sales Revenue at A.D.L.'s Projected Levels of Producer Prices	Revenue with Discount 15% (US$)	10% (US$)	7-1/2% (US$)
Antimony	6,000	6,624,000	5,552,000	5,961,600	6,120,000
Bismuth	400	3,840,000	3,264,000	3,456,000	3,552,000
Tungsten	2,000	14,000,000	20,400,000	21,600,000	22,200,000
		34,464,000	29,316,000	31,017,600	31,872,000
		Deduction of	5,148,000	3,446,400	2,592,000

reasons. First, in some cases Bolivia does not have a mineral in sufficient quantity or quality to justify commercialization. Second, a large number of non-metallic minerals are low in value in relation to bulk and, therefore, are rarely shipped long distances but rather serve the local market. This group of non-metallic minerals includes cement, gypsum, brick, block, sand and gravel, and rocks. Third, in some cases Bolivia does not have any advantage in availibility and quality of specific resources over other Andean countries. Fourth, for some non-metallic minerals and derivative products the market was not sufficiently high to justify a minimum economic scale of plant.

1. Construction Materials

The construction industry in Bolivia and throughout the world is the largest consumer of materials, and products manufactured by the non-metallic minerals industry. The basic materials used in construction are steel, cement, sand gravel, and rock. They are used in both crude form and also as major constituents in floor tile, plaster, pipe, masonry, and other specialty building products, with the exception of certain high value added non-metallic mineral products (e.g. glass, ceramic ware). Most construction products have relatively large bulk and low value and freight costs are a major element of final costs. This indicates that low value construction materials for the most part must look to the domestic market for their

principal outlets, with export markets being incremental markets. This is particularly true in Bolivia, where freight costs to markets outside the country are relatively high and most construction products have low value and are readily available in neighboring countries.

It is quite likely that a number of opportunities are available in the construction materials field. The construction industry is highly complex. It involves the non-metallic minerals, forest products, steel, and chemical industrial sectors. Many of the products of construction can be made of a number of different materials such as wood, steel or concrete framing; plastic, clay or steel pipe; wood or metal windows and doors. As a result before many opportunities are identified in this area a careful examination must be made of markets for construction materials, projecting demand, on the one hand, while noting the likelihood of substitution of one material for another, on the other hand.

2. Glass

At present Bolivia's demand for flat glass is approximately 2,500 tons each year; by 1974 this market is expected to grow to 4,000 tons. Our analysis has also indicated that it may be possible to export flat glass of a thickness greater than 4 mm and specialty glasses to the Andean Subregion. On this

basis, there may be an opportunity to establish a glass plant in Bolivia to supply the domestic market and perhaps segments of the Andean market.

Before this opportunity is implemented, however, a detailed study should be conducted to investigate factors such as the market in Bolivia and other countries in the Andean Subregion for glass of different thicknesses and specialty glasses, the type of process to be utilized, and manufacturing costs. Of critical importance would be the selection of the process. Two processes seem appropriate: the Forcault and the Pittsburg processes. The Forcault process is used in other Andean countries and is relatively inexpensive to install and simple to operate. The problem with the Forcault process is that it does not efficiently make glass with a thickness of more than 4mm.

The second process, the Pittsburg process, is more modern and requires larger investment and greater production volume to be economic than the Forcault process. It produces better glass, however, which could be exported to the other Andean countries. Such an export market is essential to make this project viable. The fact that Bolivia would be the only country in the Andean Subregion producing Pittsburg glass could result in the export of the thicker glasses as well as in the quality sensitive very thin glasses.

Starting with a glass industry oriented towards supplying the domestic market its requirements and perhaps the Andean market with certain types of glass, the industry could then be enlarged to provide specialty glasses and perhaps insulating window glass and high quality silica sand, if it is available, to the other Andean countries. Specialty glasses could be produced in a plant utilizing either the Forcault or Pittsburg process.

3. Ceramic Tile

The current market for ceramic tile in Bolivia is approximately 750 metric tons; by 1974 it will grow to 1,100 tons and by 1985 to 3,750 metric tons. On the basis of the Bolivian market alone there appears to be an opportunity for the establishment of a tile plant producing 1,500 metric tons per year.

There currently exists a number of tile plants in the other Andean countries. These plants are capable of expanding to supply the local needs. The industry in the other Andean countries is characterized by heavy competition and are relatively quality conscious. As a result of these factors, export possibilities for this industry are remote.

4. Magnesite and Refractory Bricks

A very large world market exists for high quality magnesite grain, which is magnesite rock fully benefitiated and burned to drive off various elements.

World markets can easily absorb 40,000 additional tons of this product for use in magnesite bricks, whose demand is growing in addition, the Andean Subregion also represents a market for magnesite grain since their requirements which amount to about 9,000 tons each year are nearly entirely imported. Chile and Perú are the largest importers each accounting for about 3,000 tons.

The success of this project will primarily depend on the quantity of the mineral resource, the design of the beneficiation process so that it provides the proper material for the burning process, and the design of the burning process.

At this time, our analysis has indicated that the opportunity to produce magnesite refractory brick for the world market is not very promising. The biggest and more sophisticated users of this product around the world prefer to purchase magnesite brick from firms such as Harbeson Walker and Lota-Green who provide highly technical services as part of their sales effort. Perú, Colombia and Chile all have an established industry producing refractory bricks. Colombia imports a small amount of magnesite brick but the existing industry is expanding its facilities so as to eliminate these imports. It would thus appear that the establishment of a refractory brick plant in Bolivia could not be based on finding an export market for its product in the Andean Subregion but would have to depend on the domestic market.

Bolivia currently consumes approximately 2,800 tons of non-magnesite refractory bricks per year. This demand is supplied by the existing local industry. The demand for refractory brick in Bolvia is expected to grow to 4,300 tons by 1975 and 5,000 tons by 1977.

If facilities for the production of magnesite refractory bricks are established in Bolivia, the excess production would have to be sold in external market. Alternatively the establishment of these facilities could wait until the Bolivian market is sufficiently large to justify a minimum economic scale of plant.

5. Asbestos

Over 75% of the world demand for asbestos fiber and over 90% of the demand in South America is used in cement asbestos products. Two types of asbestos opportunities were studied: asbestos fiber, and asbestos cement products.

Because of the asbestos resources available in Bolivia there may be a very large opportunity for Bolivia to become a significant supplier of astestos fiber to the world market. The major market for asbestos is in cement asbestos products. These products use asbestos grades 4, 5 and 6 which have an average world price of approximately US$ 200 per ton. The markets for the longer fibers 1, 2 and 3 are heavily oriented towards textiles, papers and specialty products. The price of these products are

declining in the world market where there is excess supply. There are also significant health implications to the use of grades 1, 2 and 3 in products for human consumption.

Our analysis has indicated that the most promising opportunity for Bolivia in asbestos fiber would be for grades 4, 5 and 6 which are used to manufacture asbestos cement products. Before this opportunity is realized, however, it must be proven that the asbestos mineral found in Bolivia is suitable for the manufacture of cement asbestos products.

The opportunity for the manufacture of asbestos cement products will depend on the quality of the asbestos mineral available in Bolivia and on the market potential for these products. Even assuming that the quality of Bolivian asbestos is suitable for the manufacture of asbestos cement products, our analysis of the market for these products has indicated that the opportunity is not very promising. All the other Andean countries have sufficient capacity for the manufacture of asbestos cement products to satisfy their domestic needs. The possibility of exporting asbestos cement products to the world market is also not very likely since transport costs would be prohibitive and sufficient capacity exists in the major markets to satisfy their local needs.

In Bolivia a cement asbestos factory with capacity of 13,000 tons commenced production in Cochabamba in 1970. This factory imports part of its asbestos fiber needs. It is of sufficient

size to fulfil local requirements for the next few years.

6. Vitreous Plumbing

At present Bolivia imports about 600 tons of vitreous plumbing each year at an average cost of US$ 590 per ton. We expect that by 1973 demand will be 925 tons and by 1985 about 2,500 tons. Our experience has indicated that the minimum required capacity is approximately 2,000-5,000 tons per year, depending on the kiln. As a result, the Bolivian market will not be sufficiently large to justify a minimum economic scale of plant for the next 8 to 10 years. The immediate establishment of vitreous plumbing facilities would need to export their excess production until Bolivian demand rose to meet capacity.

Our analysis has indicated that the other Andean countries have an excess capacity of about 5,000 tons per year. The possibility of exporting to the Andean Sub region, therefore, is limited until about 1973-1974 when capacity will be roughly in balance with demand. It is at that point that perhaps an opportunity may exist for Bolivia to establish a plant which would supply both the Bolivian market and perhaps the Andean Subregion. It must be noted, however, that if plants in the other Andean countries expand their facilities Bolivia would find it difficult to compete and the plant would have to depend on a Bolivian market insufficiently large to support the plant.

C. METAL WORKING

A significant number of opportunities exist for the establishment of metalworking manufacturing facilites in Bolivia. Tables 4, 5 and 6 present the opportunities identified by our study classified according to whether they show high promise (Table 4), medium promise (Table 5), and low promise (Table 6). The tables also indicate whether the opportunities focus on the Bolivian or Andean markets.

The markets for metalworking products will probably be limited to Bolivia, the Andean Subregion, and the Cuenca del Plata area. A number of opportunities we have identified will be solely for the Bolivian market by virtue of counter competitive transportation economics (low value per weight) or a well established industry in the other countries. Others can supply the Andean or possibly the Cuenca del Plata countries. It is doubtful that there will be attractive markets for wrought metal products beyond these two geographical areas.

In the long-run the prosperity of these projects will depend on establishing a steel sheet mill and facilities for the rolling of shapes such as angle, channel, and wide flange-beams. While it is possible to supply the Bolivian market with products using imported shapes and sheet, the export of products, where sheet and shapes represent a significant portion of total value, would be difficult.

TABLE 4

HIGH PROMISE METAL WORKING OPPORTUNITIES

NABALALC Code	Abbreviated Product Description
84.06	Engines[b]
84.22	Hoists[b]
90.14	Geodesic Instruments[b]
84.56	Mineral Crushing[b]
84.11	Fans and Blowers[a]
87.01	Tractors[b]
82.05	Interchangeable Tools[b]
84.11	Piston Compressors[a]
84.62	Bearings[b]
84.10	Pumps[a]
84.45	Machine Tools[b]
84.63	Power Transmission[b]

a. Bolivian Market Oriented; Andean Subregion Supplementary Market.

b. Andean Market Oriented; Perhaps Supplemented by other Markets.

TABLE 5

MEDIUM PROMISE METAL WORKING OPPORTUNITIES

NABALALC Code	Abbreviated Product Description
84.41	Sewing Machines[b]
84.23	Leveling & Excavating[b]
84.30	Food Machinery[b]
82.03	Pliers[b]
84.47	Wood Plastic Machinery[b]
85.05	Hand Tools/Electrical Motor[b]
84.49	Motorized Hand Tools[b]
73.32	Nuts and Bolts[a]
84.51	Typewriters[a]
73.25	Wire Rope and Cable[a]
82.02	Hand Saws and Blades[b]
88.15	Domestic Refrigerators[a]
84.14) 85.11)	Industrial Ovens and Furnaces[b]
73.18	Tubes and Pipes[a]

a. Bolivian Market Oriented; Andean Subregion Supplementary Market.

b. Andean Market Oriented; Perhaps supplemented by other Markets.

TABLE 6

LOW PROMISE METAL WORKING OPPORTUNITIES

NABALALC Code	Abbreviated Product Description
84.37	Weaving and Knitting Machinery[b]
83.15	Welding Rod[b]
82.04	Hand Tools[b] (not included elsewhere)
83.02	Door Hardware[a]
83.01	Locks and Padlocks[a]
73.21	Iron and Steel Structures[a]
82.11	Razors and Blades[b]
73.14	Iron Wire[a]
73.10	Ferrous Bars[a]
84.24	Agricultural Equipment[a]
73.36	Stoves Ovens[a]
82.01	Hand Tools for Agriculture and Forestry[a]

a. Bolivian Market Oriented; Andean Subregion Supplementary Market.

b. Andean Market Oriented; Perhaps Supplemented by other Markets.

A number of the opportunities identified in the metalworking sector are small. Typically a project at full production will have sales of about US$ 2.0 million and will require an investment of US$ 0.3 million; it will have a labor force of about 300.

As contracted with petroleum, chemical, and similar process flow industries few economies of scale exist in the metalworking industry. Exceptions may be products whose manufacture uses a tunnel or continous porcelain enamelling line such as refrigerators, stoves, washing machines and bathtubs. Also, if an internal conbustion engine plant is installed in Bolivia, the application of an automatic machining line may result in some economies of scale. In general, however, the economies gained through larger volume will be limited to the distribution of fixed costs such as management, land, building, maintenance and resources over a larger production base.

In order to gain some of these economies as well as the external economies possible through the use of common services purchased from outside along with economies in the use of infrastructure, it can be desirable to combine small projects into larger ones or even into metalworking complexes. The following indicate three possible complexes for Bolivia:

COMPLEX I - Tractors and Power Transmission Equipment

a) Engines and Compressors

b) Tractors and Forklift Trucks

c) Agricultural Implements

d) Trucks and Trailers

e) Power Transmission and Material Handling Equipment

COMPLEX II - Mining and Related Equipment

a) Mineral Crushing and Screening Equipment

b) Pneumatic Mining Equipment

c) Grain Crushing and Sorting Equipment

d) Wood Treatment Equipment

e) Pressure Vessels

COMPLEX III - Machine Tools

a) Steel Working Tools

b) Stone Working Tools

c) Wood and Plastic Tools

d) Accesories

D. ELECTRICAL-ELECTRONIC

There are several significant opportunities for Bolivia to manufacture electrical and electronic goods for the Bolivian and other Andean markets. As indicated in Table 7, we have identified four opportunities - motors and transformers, insulated wire, switchgear, and radio receivers - as having high promise. Four more

TABLE 7

CLASSIFICATION OF OPPORTUNITIES
ELECTRICAL-ELECTRONIC SECTOR

High Promise

85.01	Motor and transformers
85.23	Insulated Wire
85.19	Switchgear
85.15	Radio receivers

Medium Promise

85.11	Furnaces, welding equipment, etc.
85.06	Domestic appliances
85.18	Capacitors
85.04	Storage batteries

Low Promise

85.13	Telephone equipment
85.12	Heating devices
85.08	Starting & ignition equipment
85.03	Dry cells
85.20	Lamps

opportunities appear in the medium promise bracket, and an additional five industries are rated as carrying low promise. Although we have tried to rank these thirteen opportunities in terms of their relative desirability, the differences between many of them are slight and we recognize that other analysts might array them differently. Certainly, several of them deserved further study, and those of high promise should be investigated first.

We believe that motors, possibly coupled in the same plant with transformers, switchgear and the fabrication of wire represent the three most promising opportunities for Bolivia. The fourth ranked opportunity is based on the implementation of a radio assembly plant, to be supplemented by phonographs, tape recorders, telephone receivers, and finally electronic components.

Bolivian enterprise will have to be able to meet the competition of the other Andean countries in most of the opportunities that have been identified. We do not expect that these opportunities, if implemented, will make an impact beyond the Andean market except possibly in the Cuenca del Plata countries.

Some products because of the high transport costs associated with low value per unit of weight or bulk will be saleable only in Bolivia, or possibly Northern Chile and Southern Perú. And some products may be confined to the Bolivian market by well established manufacturers in the other countries.

The initial investment for electrical opportunities is on the average smaller than for most other sectors. The average investment to implement a minimum viable plant is in the range from US$ 300,000 to US$ 500,000.

E. CHEMICALS

Table 8 lists the opportunities we identified in the chemicals sector according to whether they are oriented to the Bolivian or Andean market and according to their order of priority.

1. Andean Market Oriented Opportunities

a. Titanium Dioxide

An analysis of the market for titanium dioxide in the Andean Subregion indicates that there will be a production deficit of 15,000 tons with a value of US$ 15,000,000 by 1975. Since there are no known exploitable reserves of rutile and ilmenite ores, the raw materials used to produce titanium dioxide, in Colombia, Chile, Perú and Ecuador, Bolivia is at no particular disadvantage in the production of this inorganic pigment. Moreover, there are indications that there might be deposits of ilmenite and rutile ores in Bolivia. Since titanium dioxide is a high value product capable of absorbing large transport costs and since the minimum economic scale of plant is in the range of 15,000 tons-20,000 tons, the production of titanium dioxide from either

TABLE 8

RANKING OF OPPORTUNITIES
BASIC CHEMICALS SECTOR

Priority	Opportunity	Annual Sales Tons	Annual Sales Value (US$)	Estimated Investment (US$)	Projected Startup Date	Bolivian Resource
Andean Market Oriented Opportunities						
1.	Titanium dioxide	15,000	8,900,000	20,000,000	1974	Ilmenite or rutile if exist
2.	Lube Oil additives	-	8,000,000	-	1974	-
3.	Xanthates	8,000	3,700,000	-	1974	Sulphur, ethyl alcohol
4.	Sodium cyanide	6,000	3,400,000	1,500,000	1974	Natural gas ammonia and caustic soda
5.	Zinc oxide	12,000	5,300,000	-	1985	Zinc
6.	Copper oxide	2,000	3,000,000	-	1974	Copper
7.	Ferric oxide	5,000	1,900,000	-	1985	Ferric oxide
Local Market Oriented Opportunities						
1.	Nitrogen Fertilizer	75,000(urea) 15,000(AN)	-	14,000,000[1]	1973	Natural gas
2.	Explosives	15,000	-	1,000,000[1]	1973	Ammonium nitrate fuel oil
3.	Pharmaceuticals	-	1,500,000	750,000	1972	-
4.	Soda ash 3000(Na_2CO_3) Caustic soda 5000(NaOH) Sodium silicate 2000 (Na_2O-$nSiO_2$)		200,000 600,000 200,000	3-5,000,000	1973	Trona, sand and lime
5.	Xanthates	600	250,000	-	1974	Ethyl alcohol
6.	Phosphate Fertilizer	80,000	-	3,000,000[1]	1973	Sulfuric acid
7.	Shoe polish	90	80,000	-	1972	-

1. Investment estimates from Ministry of Planning.

domestic or imported raw materials represents a very promising opportunity for Bolivia.

b. Lube Oil Additives

Imports of lube oil additives were approximately US$ 9.0 million in 1968. This amount is sufficient to justify the establishment of a lube oil additives plant. The establishment of a plant in Bolivia would require the participation of one of the major lube oil producers. This partner would provide the basic raw materials which would have to be imported, the technology and the licenses, and the technical assitance and training that would be essential for the success of this industry.

c. Xanthates

In 1968 Bolivia imported 320.3 tons of xanthates with a value of US$ 136,500; in the same year the Andean Subregion including Bolivia imported 3,836 tons with a value of US$ 2.5 million. By 1975 we have projected demand at 8,100 tons and by 1985 at 16,000 tons. Xanthates are currently not produced in the subregion.

The most common xanthate, which is used as a flotation agent in the mining industry, is sodium ethyl xanthate. It is produced by reacting sodium hydroxide, ethyl alcohol, and carbon disulphide. Sodium hydroxide and ethyl alcohol are currently being produced in Bolivia and carbon disulphide could either be imported or produced from imported coal and local sulphur.

Xanthates thus have all the characteristics that would make the manufacture of this product of interest to Bolivia. They have value; the market in the subregion is sufficiently large to justify an economic sized plant; and Bolivia has the major part of the resources required for their production. The market for xanthates in Bolivia is also sufficiently large to warrant the establishment of production facilities.

d. Sodium Cyanide

Sodium cyanide is produced by reacting hydrogen cyanide and caustic soda. The hidrogen cyanide is in turn produced by reacting natural gas, ammonia, and air. All of these basic raw materials are currently available in Bolivia or are expected to be available in the near future.

An analysis of the market of socium cyanide in the Andean Subregion indicates that 2,563 tons were consumed by the Andean countries in 1968, representing a value of US$ 712,000. In 1975 it is expected that the Andean Subregion will consume 5,000 tons with a value of US$ 3.2 million and by 1985 12,000 tons with a value of US$ 4.8 million.

At present there is no production of sodium cyanide in the Andean countries. Perú, however, has announced plans to manufacture9,000 tons of sodium cyanide by 1972. Although the state of [illegible] of Perú's plans have not been firmly determined, it

appears that 6,000 tons of capacity are under construction and 3,000 tons are at the planning stage. The extent of this opportunity depends on whether or not Perú's plans are realized. On the one hand, if Perú has a plant by 1973 it will have the capacity to supply the Andean Subregion and there will be no opportunity for Bolivia. On the other hand, if Perú's plans are not realized then a promising opportunity exists in Bolivia for the manufacture of sodium cyanide.

e. Inorganic Pigments

The inorganic pigments considered are zinc oxide, copper oxide, and ferric oxide.

i. Zinc Oxide

At present the market for zinc oxide in the Andean Subregion is 4,500 tons per year. Capacity is 5,900 tons with Colombia, Chile, and Perú having manufacturing facilities. It appears, therefore, that there is sufficient installed capacity in the Andean Subregion to meet existing requirements.

The demand for zinc oxide in 1975 will be 6,800 tons and in 1985, 14,000 tons. If capacity is not increased in Colombia, Chile and Perú, there will be a supply deficit of 900 tons in 1975 and 8,100 tons in 1985 and an opportunity will exist for the establishment in Bolivia of zinc oxide production facilities.

ii. Copper Oxide

Consumption of copper oxide in the subregion was 1,234 tons in 1968. The bulk of consumption was accounted by Chile who also had the only installed capacity (300 tons) to manufacture this product. Chile is also one of the world's largest producers of copper. As a result, even though the production of copper oxide prepresents an opportunity on the basis of the subregional market, Chile has the comparative advantage and it does not represent a promising opportunity for Bolivia.

iii. Ferric Oxide

Consumption of ferric oxide in the Andean subregion was 1,676 tons in 1968. Of this amount 500 tons were produced within the area and 1,176 tons were imported. Production capacity was 680 tons and was located in Colombia and Chile.

We have projected the market for ferric oxide at 2,500 tons in 1975 and 4,700 tons in 1985. If installed capacity does not increase the supply-demand deficit will be 1,820 tons in 1975 and 4,020 tons in 1985. As a result, an opportunity may exist over the longer term for the production of ferric oxide in Bolivia for export to the Andean market.

2. Bolivian Market Oriented Opportunities

a. Nitrogen Fertilizer

A number of detailed studies have been conducted on the feasibility of producing nitrogen fertilizers in Bolivia. Two of the more comprehensive studies were performed for YPFB by the Kellogg Company and by the Tennessee Valley Authority, both of the United States. Their reports recommend the establishment of a fertilizer complex to produce primarily urea and also ammonium nitrate. We are in basic agreement with these recommendations and hope that this project will soon be implemented.

b. Explosives

A detailed study on the feasibility of producing explosives in Bolivia was conducted for YPFB by the Kellogg Company in 1965. This study recommended the production of ammonium nitrate and fuel oil explosive mixtures to replace dynamite which is currently used primarily in the mining industry. The ammonium nitrate would be obtained from the fertilizer complex which will be producing this material. We are in general agreement with the conclusions of the Kellogg report and recommend that this project be implemented.

c. Pharmaceuticals

The current total market for pharmaceuticals in Bolivia is

about US$ 7,000,000 of which about US$ 2,000,000 or 38.5% is accounted for by local production. Because of the complexity of the pharmaceutical industry, it is imposible to identify specifc products that offer potential for Bolivian production without conducting a prefeasibility study. On the other hand, our experience in countries similar to Bolivia indicates domestic production should account for 50-60% of sales. As a result, there is probably a possibility for additional production in Bolivia of between US$ 1.25 million to US$ 2.0 million primarily to supply local markets. There is also a possibility that some products could be exported to Andean markets but this would depend on how the pharmaceutical industry is programmed within the Andean Pact.

d. Soda Ash, Caustic Soda, and Sodium Silicate

In 1968 Bolivia imported 1,029 tons of soda ash with a value of US$ 80,900, 1,010 tons of caustic soda with a value of US$ 104,000, and 1,024 tons of sodium silicate with a value of US$ 92,000. We have projected the Bolivian market for these products in 1975 and 1985 as follows:

	1975 (tons)	1985 (tons)
Soda Ash	1,450	4,300
Caustic Soda	2,000	5,000
Sodium Silicate	1,600	4,000

Bolivia has the raw material (trona) required to produce soda ash. The soda ash can then be reacted with lime to produce caustic soda and it can also be reacted with silica (sand) to produce sodium silicates.

Bolivia thus has an internal market sufficiently large to support a small plant for the manufacture of these products and the raw materials they require. We rate this project as a good opportunity.

e. Phosphate fertilizer

Phosphate fertilizers are produced from phosphate rock and sulphuric acid. Under ordinary circumstances, we would probably not recommend the establishment of a phosphate fertilizer plant in Bolivia primarily because Bolivia does not have any known exploitable reserves of phosphate rock. In the near future, however, it appears that there will be large quantities of sulphuric acid available for which there appears to be no market in Bolivia and little possibility for exporting the product. Since phosphate fertilizers are produced from sulphuric acid and phosphate rock, their production should be further studied.

f. Shoe Polish

In 1963 about US$ 80,000 of shoe polish was imported into Bolivia. The local market is sufficiently large to justify the

establishment of a small plant and represents a promising opportunity for the local entrepreneur.

F. FOREST PRODUCTS

Bolivia's forest resources indicated that they are abundant and varied. The woods of greatest export potential appear to be mahogany, cedar, ochoo, walnut-tree and red quebracho. There are, however, a multitude of other species which should also prove exportable, especially to Argentina.

The forests of the other Andean countries are similar to those of Bolivia with the exception of those of Chile which are temperate rather than tropical. Only Chile lacks the precious woods found in Bolivia, mainly mahogany and cedar. However, Chile has many valuable woods of its own and thus it is unlikely to import large quantities of mahogany and cedar.

The cost of transporting lumber represents a large portion of the finished product in the final market, therefore, it is not probable that it will be possible for Bolivia to export standard wood products to the other Andean countries inasmuch as they are capable of producing the same products at lower cost due to transportation savings.

Based on the analysis of resources and markets and minimum economic scale of plant the following opportunities have been identified:

1) Lumber exports to Argentina

2) Mahogany exports to the United States

3) Specialty papers

4) Quinine

5) Pencil manufacture

6) Low priced wooden furniture

7) Other such as high quality artistic parket flooring, wooden brushes, and the production of artistic wood products.

1. Lumber Exports to Argentina

Unlike the Andean countries, Argentina has insufficient forest resources and also lacks the precious species found in Bolivia. There appears to be potential for increased exports from Bolivia to Argentina, of both construction timbers and precious woods. In order to serve this market Bolivia would have to become more competitive than it is currently, because of the increasing competition in this market from Paraguay and Chile. Ochoo, the most abundant species in Bolivia, would represent a source of low cost timber for the Argentine market. There are problems that would need to be solved, however, in the processing and use of this wood. It would have to be dried and perhaps treated with wood preservatives in order to be of acceptable quality. In our opinion, ochoo can be produced at a cost which would make it competitive with imported pino araucaria and pino insigne.

2. Mahogany Exports to the United States

Bolivia's geographical position accounts for exceptionally high cost of transportation of finished products to market. The cost of exporting mahogany lumber to the United States from Bolivia, for example, ranges from US$ 115 to US$ 125 per thousand board feet. This compares quite unfavorably to the cost of shipping lumber from Southeast Asia to the United States which is about US$ 90 per thousand board feet. Due to the abundance of timber availability in Souteast Asia and low costs of production and of transportation, it is expected that Bolivia will have difficulty competing with non-precious woods from Southeast Asia in both the U.S. and European markets. Africa also has lower costs as well as a broader market for more wood species which permits lower extraction costs and in addition it receives preferential tariff treatment in European markets making it extremely difficult for Bolivia to compete in European markets. In addition, most of the exports from Africa to Europe are in log for permiting European countries to manufacture lumber themselves in processes which provide both economies of scale and high yield production from the logs as well as utilization of the by-products of lumber and plywood manufacture in the form of composition board products.

African mahogany is widely accepted in Europe and it is available at significantly lower cost than is tropical American

mahogany. For this reason very little tropical American mahogany is currently used in Europe. Most of the use is in the United States.

Bolivia has been in past years exporting mahogany to the United States. The U.S. market for mahogany is primarily the furniture market and style trends in recent years have been away from the use of mahogany. If mahogany remains a precious, high cost wood it is quite unlikely that style changes will create strong demand for Bolivian mahogany sufficient to justify the establishment of a major increase in saw-mill capacity in Bolivia. If, however, the cost of mahogany delivered to the users in the United States can be reduced by US$ 80-100 per thousand board feet the lower price might well induce sufficient expansion in the use of mahogany to permit rapid expansion of Bolivia's industry.

We have examined the cost of producing and delivering mahogany to the United States from Bolivia and have ascertained that wood costs might be reduced by about US$ 30, transportation costs by US$ 10, manufacturing cost by US$ 10, and wholesale costs in the U.S. by perhaps as much as US$ 50.

3. Specialty Papers

One broad area of opportunity for Bolivia has importance in terms of the Andean market. This is the production of specialty papers which would include cigarrette paper, filter paper, glassine,

consider tissue as well as some production of legal papers, checks, tickets, title papers, etc. Although the import data for Andean countries are not sufficiently precise to indicate with certainty the quantities of these special paper grades that are imported, it appears that there is sufficient volume in the five Andean countries as a whole to justify the establishment of a specialty paper mill. Such a mill makes particular sense for Bolivia since it would produce the highest value paper; paper which can absorb the cost of transport. It is also a grade of paper which is normaly made in small mills; thus, Bolivia with a small mill could be competitive in the export market. We recommend that Bolivia consider the establishment of a specialty paper mill with a capacity of 10,000 to 15,000 tons per year, permitting annual sales of US$ 3 million to US$ 4.5 million. Our preliminary investigation indicates that demand in the Andean countries for these special grades is probably less than US$ 6 million to US$ 8 million. Nevertheless, this investigation indicates that there may well be already sufficient demand to provide the US$ 3 million to 5 million sales volume required of the proposed plant.

The specialty paper mill would require an investment of about US$ 5 million. The investment cost is quite high relative to the volume of paper produced, and the high capital cost burden accounts in great part of the cost of specialty papers. Specialty papers also require a great deal of labor in stacking, cutting,

and counting the types of paper produced. The proposed plant would employ between 150 to 250 people. Reportedly, Chile and Colombia are also interested in the establishment of specialty paper mills.

The pulp of this proposed plant would be imported and thus would permit Bolivia to get into paper production with a minimum of investment. We do not recommend the establishment of a pulp mill to provide the pulp for the specialty paper mill because the economies of scale realized in specialty pulp production are so great as to make it much less costly for Bolivia to import the pulp than to manufacture it within the country.

4. Quinine

The fourth major opportunity identified in the course of our study is the production of quinine from chinchona bark. The existing capacity in Bolivia is now being expanded which would permit utilization of 600,000 kilos of bark per year and recently Bolivia has enacted legislation prohibiting the export of chinchona bark. Quinina production is extermely profitable since the value of chinchona bark is now about US$ 40 a kilo and the cost of extracting quinine is very low. The cost of shipping quinine is insignificant relative to its value; in the order of 1% of the cost of the product delivered in Europe. Because the native chincona bark resource appears to be close to liquidation such

that the available supply may be insufficient in a few years to permit the existing industry to operate at capacity, we recommend that Bolivia seek to establish chinchona plantations. It is our understanding that relatively few areas in the world are capable of growing high value chinchona bark and, therefore, Bolivia should exploit this potential.

5. Other Opportunities

The other opportunities identified in the forest products sector provide a more limited basis for industrial development. Pencil manufacture, for example, appears to be an opportunity. While the demand for pencils in Bolivia is not sufficient to justify a pencil fabrication plant, the demand in the Andean countries as a group appear to be sufficient. It is believed that Bolivian wood species would be suitable for manufacture of an adequate pencil such as that currently imported from Brazil. We therefore recommend that this project be investigated further especially since reportedly two pencil manufacturing machines are already in Bolivia but which, for undisclosed reasons, have not been able to get into production.

There also appear to be opportunities for the production of low priced wooden furniture in Bolivia as well as perhaps the production for export of high quality artistic parquet flooring, the production of wooden brushes produced on a very small scale

for domestic consumption, and the production of artistic wood products such as carved heads, and the like, which might be produced on a factory scale for export. Such opportunities call for facilities which would employ only about 25 people and thus would not represent major expansions but would nonetheless merit promotion by the Bolivian Government.

G. FOOD PRODUCTS

Table 9 indicates opportunities in the food products sector of the Bolivian economy identified as having high and medium promise.

1. Beef

Our analysis has indicated that beef is the most promising opportunity for Bolivia in the food products sector. The establishment of this industry would be oriented towards supplying the Peruvian and Chilean markets.

Both Perú and Chile are currently substantial importers of beef. Published statistics indicate that in 1968 alone, Perú imported 50,000 metric tons of beef and Chile 33,000 metric tons.

Chile and Perú have indicated, however, that they have plans for becoming self-sufficient in beef by 1980. We would question whether this goal can be met in view of past performance of both countries in cattle breeding and since to achieve this goal would

TABLE 9

RANKING OF OPPORTUNITIES

Opportunity	Bolivian Resource	Promise	Markets
1. Beef, chilled in carcass form	Cattle in low land area	High	Mainly the export markets of Southern and Central Perú and Northern and Central Chile, with emphasis upon urban centers.
2. Trout; commercially farmed, frozen smoked or canned.	Unused mountain - streams of uncontaminated water	High	North America, Europe and major Latin American urban centers.
3. Animal feeds: produced from domestic raw materials and some imported ingredients.	Hitherto wasted by-product of oil-mills, breweries, etc.	High	The domestic beef cattle industry producing for export and the domestic dairy cattle.
4. Vegetable oils; produced from domestic raw materials.	Unused raw materials, such as rice bran, large part of the cotton-seed, and new crops, such as sunflowerseed, soybeans, etc.	High	Substitute for imported vegetable oils: 95 of present consumption. Possibly exports to Andean countries in a second stage.
5. Pyrethrum; dried flowers and extract.	Geographic location, climate and fallow land.	High	Main market for extract in the U.S.A. with Europe a secondary market. Market for dried flowers in LAFTA countries.
6. Dairy products; a substitute for the large volume of imported milk powder.	Dairy cattle in the area around 2,000 m. above sea level	Medium	Oriented towards domestic market and perhaps Perú and Chile in a later stage.
7. Concentrated citrus juice	The already substantial production of good quality oranges, tangerines and lemons	Medium	The large industrial and wholesale markets in Europe and the U.S.A.
8. Essential and industrial vegetable oils.	Climatic and soil conditions as evidenced by existing large variety of oil bearing plants.	Medium	The perfume and cosmetic markets in Europe and the U.S.A. The industrial buyers of specialized industrial oil producers.

require an extraordinarily large increase in the size of the total cattle population in both Chile and Perú. For these reasons we predict an increase of beef imports by both Chile and Perú during the 1970-1980 period.

Bolivia would be competing in the Peruvian and Chilean markets with Argentina, Colombia and Ecuador. At present both Colombia and Ecuador are not exporters of beef. The export of beef from Ecuador to Perú is mainly cattle on the hoof and is consumed in the Northern part of Perú.

Bolivia will be competitive in the Peruvian and Chilean markets provided that it can:

a. Guarantee the volume of carcass meat on a dependable and regularly scheduled basis;

b. Supply beef of the quality demanded by these markets, which are exigent both in terms of the inherent quality of the meat and of its sanitary aspects;

c. Supply carcass beef at competitive prices.

2. Cultivated Trout

Trout cultivated in ponds and harvested as any other agricultural crop is a high value item whose market is primarily in the United States and Europe. Other markets might also be located in

major urban centers in Latin America where relatively high incomes and a developed tourist industry would probably make it an attractive item.

In recent years the market for trout in North American and Europe has been increasing quite rapidly, a condition we expect will prevail in the future. The increasing concern of North American and European consumers with contamination of fish by pollution of its natural environment may be a strong sales advantage for trout produced in uncontaminated Bolivian waters.

Our preliminary investigation has indicated that it is quite likely that Bolivia has the environmental conditions suitable for the production of trout. The streams on the slopes of the Yungas and the Cochabamba area appear to be particularly well suited for the location of this project.

The project would initially consist of a pond complex having one and one half hectare of surface water capable of producing 1,000 tons of trout from imported eggs by the second year of production. Air transport of trout eggs is a well developed procedure and the cost of trout eggs is sufficiently low to affect import of excellent quality material from any part of the world.

Annual production of 1,000 tons of trout is about 10% of present import by major trout consuming countries. Taking into account that the potential market for Bolivian trout is not

only the United States market, but also Europe and major Latin American urban centers, it should not be difficult to sell 1,000 tons of trout each year.

3. Animal Feed

An animal feed industry would be the nucleous of an integrated complex of industries as indicated in Figure 1. It would be the between the, hetherto wasted, by-products of agricultural enterprises such as oil mills, on the one hand, and dairy cattle farmers, for example, on the other hand.

The industry would be oriented towards supplying the domestic Bolivian market since the other Andean countries have well established animal feed industries. The majority of raw materials inputs required for animal feed production would be supplied by existing Bolivian industries. It may be necessary, however, to import small quantities of the raw materials required to obtain a balanced ration.

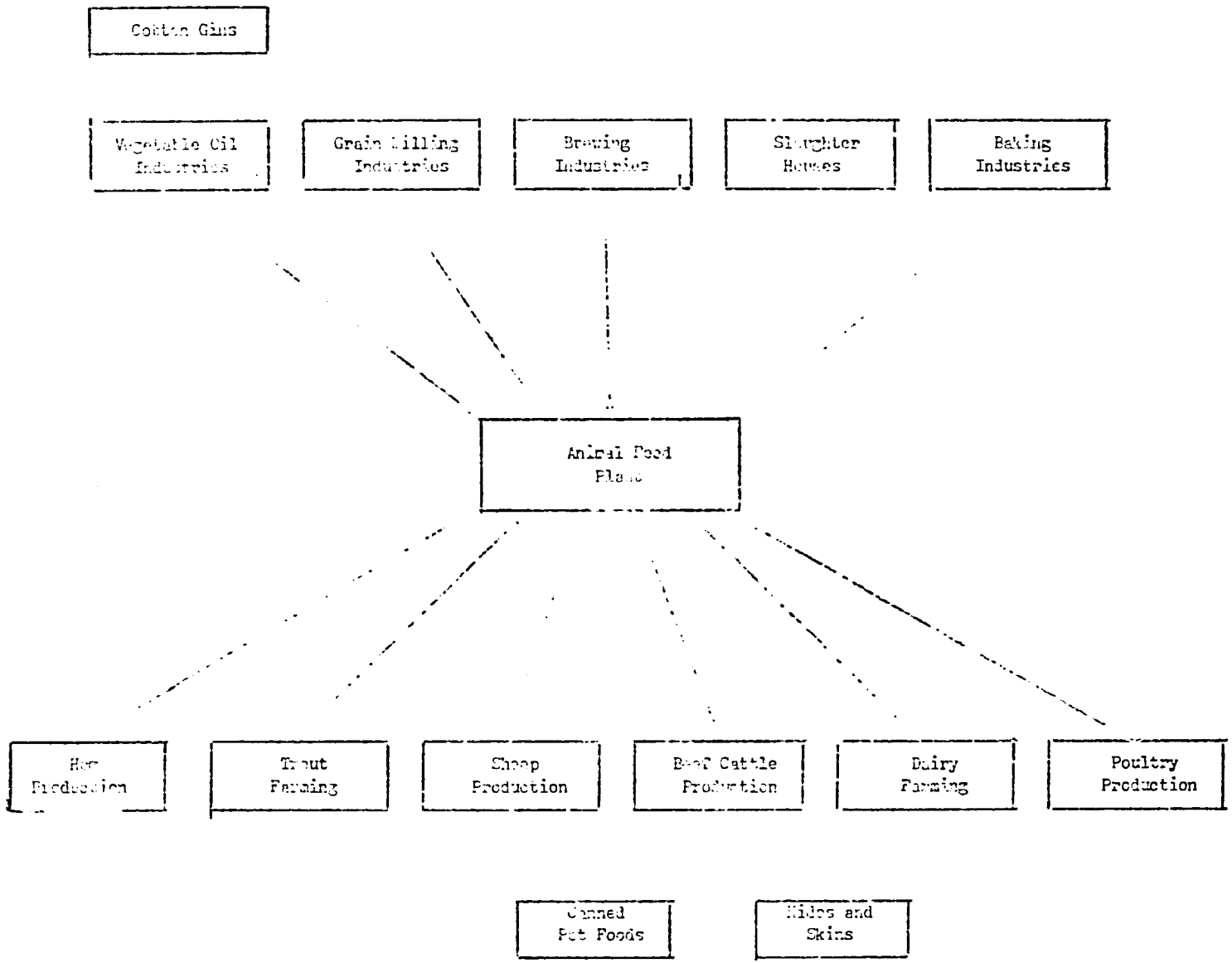
Animal feed would be utilized for the production of livestock products some of which, such as beef and trout,may have export possibilities.

4. Vegetable Oils

Bolivia currently imports approximately 5,000 metric tons of vegetable oils per year or about 95% of its total consumption.

FIGURE 1

INTEGRATED AGRO-INDUSTRIAL COMPLEX



Other Andean countries currently import aproximately 50,000 tons of vegetable oils and fats. Of these Perú is the most significant importer accounting for about 40-50% of the total.

The industry would be oriented towards supplying the Andean market. It is doubtful, although this would need to be verified in a prefeasibility or feasibility study, that the Bolivian market is sufficiently large to support a minimum economic scale of plant.

The industry would process all the oilseeds currently grown in Bolivia including cottonseed, soybean and babasú. The industry should also process hitherto unused sources of vegetable oil such as rice bran. The use of rice bran, a by-product from rice milling appears to be a significant opportunity since large quantities presently are burned. If the present trend towards growing soy-beans continues, the crushing of this commodity will provide not only a high quality oil but also a high protein cake which has a good market as an ingredient in animal feed production.

5. Pyrethrum

Prior to the introduction of DDT and other pesticides based on chlorinated hydrocarbons, pyrethrums were widely used for the control of insect pests. With the development of synthetic compounds which gave good control at lower costs per hectare, pyrethrums were neglected. Recently, however, increasing apprehension

over the serious problems of toxicity resulting from the continued massive application of synthetic pesticides has revived interest in the use of pyrethrum for vegetable and forest insect control. As a result, we expect that the market for biological pesticides such as pyrethrum will grow in the future.

Although the market for pyrethrum is worldwide, the United States historically has absorbed 75% of world production. It is quite likely, therefore, that the development of a pyrethrum industry would have to be oriented to selling its product on the United States' market.

Pyrethrum would be sold on the United States market as an extract and not as dried flower. There are a number of reasons for this. First, the United States is accustomend to purchasing the extract and not the dried flowers. Second dried flowers are bulky and would have substantially higher transport costs than the equivalent extract. Third, considerable value is added by processing the flower into extract.

The production of the pyrethrum most suitable for insecticides requires a moderate climate. It is not particular with regard to soils, but requires meticulous tending and weeding. It needs moderate amounts of rainfall. Since it requires chilling for bud initiation and also since some experts claim that higher yields are achieved with increasing intensity of ultraviolet radiation, it appears that high altitude regions near the

equator are particularly well suited for Pyrethrum cultivation. The Bolivian Altiplano region appears to have most of the conditions required for growing pyrethrum. There exists, to our knowledge, only two other areas of the world, Ecuador and Kenya, possessing a combination of factors similar to those existing in Bolivia for the production of pyrethrum- both countries are major producers of pyrethrum.

6. Dairy Products

Although dairy products were not included within the terms of reference of our study we believe that it could represent an important opportunity for import substitution in Bolivia and perhaps over the longer term for export to Perú and Chile.

In 1967 Bolivia imported approximately US$ 2.8 million of mill products. This amount was divided among the different products as follows:

Evaporated Milk	US$	374,000
Condensed Milk		490,000
Powdered Milk with 24% or less fat		700,000
Powdered Milk with 24% or more fat		1,163,000
Cheeses		39,700
Other		33,300
T o t a l	US$	2,800,000

Bolivia currently produces approximately 28,400 metric tons of fresh milk, 600 metric tons of powdered milk and 5,300 metric tons of cheese. There appears to be a substantial opportunity for t he existing industry to expand its facilities , to reduce its production costs and to substitute for imports. After Bolivia fullfils its own domestic market requirements there may also be an opportunity to export milk products to Perú and Chile, both of which are substantial importers, provided that Bolivia builds up its raw material production and reduces production costs to levels comparative with foreign competition.

7. Concentrated Orange Juice

Concentrated orange juice is one of the most successful products ever introduced on the consumer market. Consumption in the United States grew very rapidly after it was initially introduced.

Since the early 1960, the European consumer has eagerly accepted this product. Unlike the United States, however, a significant portion of the European market is supplied by imports. It is quite likely that the development of a concentrated orange juice industry in Bolivia would be oriented towards supplying the European market. Since consumer preference in Latin America is largely for fresh oranges we do not regard this market to be very interesting for Bolivia.

Bolivia, at present, produces approximately 60,000 tons of good quality oranges and tangerines. Prices during the harvesting season are low relative to any standard. The development of this industry could start utilizing 10% to 20% of existing raw materials supplies. The plant should produce a relatively new high concentrate that is thermostable at ambient temperatures and, therefore does not require freezing. This 6:1 "hot pack" concentrate is readily acceptable by the trade in lieu of its predecessor, the 4:1 frozen concentrate.

8. Essential and Industrial Vegetable Oils

In the course of conducting the opportunity survey for this sector we considered Bolivia's raw materials. This examination indicated that there existed in Bolivia vegetable plants from which oil could be extracted having a value of up to US$ 10,000 - US$ 15,000 per ton.

This group of oils can be divided into two categories: (1) essential oils used by the perfume industry and (2) industrial oils used by the paint, varnish, plastic, and specialized lubricating industries.

Three of these are parchouli, avocado and ricinus oils. Patchouli oil is used in almost any quality perfume and has been grown in Latin America e.g. Brazil. Avocado oil has only recently been introduced in the market and it is used as a "base" in

high priced cosmetics. Ricinus oil is produced from castor seeds and it is used in a variety of industries where it is valued for its drying or lubricating characteristics.

H. CONSUMER GOODS AND LIGHT INDUSTRIAL PRODUCTS

A significant number of opportunities exist in the consumer goods and light industrial products sector of the Bolivian economy. Tables 10, 11 and 12 present the opportunities identified by our study according to whether they show high promise (Table 10), medium promise (Table 11) and low promise (Table 12).

In the following paragraphs and in order more or less related to the level of promise, we discuss the high and medium promise opportunities.

1) Textile Including Garments

The Bolivian textile industry includes the following segments:

a. Manufacture of Garments

b. Weaving and Knitting

c. Spinning of Yarn

d. Production of Fibers

e. Manufacture of Special Purpose Textile Materials

TABLE 10

HIGH PROMISE CONSUMER GOODS AND LIGHT INDUSTRIAL PRODUCTS OPPORTUNITIES

NABALALC Code	Abbreviated Product Description
91.01	Wrist watches, including pocket watches
61.02	Women, girls, infants outergarments
87.09	Motorcycles, including motorbycicles
87.10	Cycles not motorized, including bicycles and tricycles both for children and delivery use
42.03	Leather apparel
42.02	Leather travel goods
61.01	Men and boys outer garments

TABLE 11

MEDIUM PROMISE CONSUMER GOODS AND LIGHT INDUSTRIAL PRODUCTS OPPORTUNITIES

NABALALC Code	Abbreviated Product Description
40.10	Transmission belting of rubber
53.05	Wool, carded and combed
40.09	Pipe and tube of rubber
40.14	Other articles of rubber
56.05	Synthetic yarn, including 56.05 and 56.06
60.01	Knitted or crocheted fabric
61.03	Men and boys undergarments
97.03	Other toys and working models
61.05	Handkerchiefs
62.03	Sacks and bags of textile material
55.09	Cotton, woven fabric
61.04	Women, girls and infants undergarments
53.11	Woven wool fabric

TABLE 12

LOW PROMISE CONSUMER GOODS AND LIGHT INDUSTRIAL PRODUCTS OPPORTUNITIES

Nabalalc Code	Abbreviated Product Description
98.03	Fountain pens, ballpoint pens and mechanical pencils
60.03	Stockings and socks, knit or crocheted
97.02	Dolls
97.04	Parlor games
41.02	Tanned bovine cattle leather
51.04	Woven synthetic fabrics
56.04	Synthetic fibers prepared for spinning
60.05	Outergarments, knitted or crocheted
90.07	Cameras and flash apparatus
56.07	Synthetic woven fabrics of discontinuous fiber
51.04	Woven synthetic fabrics, continuous fiber
96.02	Other brooms and brushes of material, other than twigs or vegetable material
59.17	Textile fabrics, industrial usage
90.08	Projectors and sound recorders
58.10	Embroidery
53.07	Wool yarn
60.04	Knit or crocheted undergarments
59.16	Textile conveyor or industrial belting
37.01	Photographic plates and film
37.02	Photographic materials, film in rolls
37.03	Sensitized photographic paper

Bolivia's opportunity to export textile products to the Andean Subregion is inhibited by the existence of textile industries in each of the Andean countries. In particular Colombia has a well developed and efficient textile industry. In view of this situation there is little or no opportunity for Bolivia to export yarns or fabrics to the Andean Subregion. On the other hand, five product categories comprising of outer garments and undergarments for women, girls, infants, men and boys and of handkerchieves are imported in significant quantities into the subregion and represent significant potential markets in Bolivia. In particular two categories, women, girls and infants outergarments, and men and boys outergarments are both opportunities of high promise when considered individually. When these five products, of which three are opportunities of medium promise, are grouped an opportunity for their export results. The market for this group of products in 1967 was as follows:

Market	Value (US$)
Bolivia	455,000
Andean Subregion	4,897,000
LAFTA	14,807,000

It is not unreasonable that Bolivia could achieve a 20% market penetration in the Andean countries yielding nearly US$ 1.0 million in sales plus additional sales in the Cuenca del Plata area. In order to achieve market penetration of this magnitude, taking

into account a developed garment industry in each of the markets considered, a very aggressive and well organized marketing campaign would need to be conducted. Marketing and production would have to be oriented towards supplying high quality merchandise at competitive prices.

The implementation of this opportunity would also have a positive influence on the remainder of the textile industry in Bolivia. The export of garments would increase the demand for additional woven and knitted products and stimulate the development of Bolivia's textile industry.

2. Watches, Wrist and Pocket

Watches, particularly wrist watches, have been identified as a high promise opportunity for Bolivia. Imports of wrist watches into Bolivia, the Andean Subregion, and LAFTA are US$ 900,000; US$ 4.0 million and US$ 15.0 million, respectively.

Although there is some production of wrist watches in the Andean Subregion there may be an opportunity for Bolivia to satisfy as much as 50% of the market. The implementation of this project would need to be conducted in several phases. In the first phase all the components of the watch would be purchased and the watch assembled, lubricated and adjusted. The level of integration would probably not exceed 15% in the first phase.

The second phase of the project would include the manufacture of watch cases either by stamping or coining and the fabrication of watch faces. When this step is combined with the manufacture of the crystals, the level of integration can be as high as 50%, which is comparable to the integration of virtually all watch manufacturers except for a very few who also produce watch movements. Most manufacturers of watches purchase watch movements from Japan, Switzerland and Germany.

The project would be relatively labor intensive and would require substantial training of the employees.

The minimum viable first phase plant would have sales of US$ 100,000 and would require equipment investment of US$ 30,000. The equivalent minimum economic plant would have sales of US$ 400,000 and equipment investment of US$ 75,000. Working capital requirements are estimated at 25% of sales, building investment at US$ 40,000.

3. Motorcycles, Bicycles, etc.

This project includes motorcycles, motor-bicycles, and tricycles. There are presently two bicycle plants in Bolivia; therefore the identification of bicycles and tricycles as an opportunity is dependent on whether Bolivia's existing industry can satisfy demand for these products.

A motorcycle plant would focus primarily on the Andean market which currently imports motorcycles having a value estimated at US$ 2.6 million; a supplementary market would be LAFTA which imports approximately US$ 2.8 million of motorcycles. Apparently less than 10% of the market for motorcycles is satisfied by production within the Andean Subregion and LAFTA.

We anticipate that the manufacturing process would consist of fabricating the frame and components; the internal combustion engine and transmission would be purchased. The level of integration is estimated at approximately 50%.

Sales, equipment and building investment, and working capital for the minimum viable and minimum economic plants would be as follows:

Plant	Sales	Equipment Investment	Working Capital	Building
Minimum Viable	US$ 300,000	US$ 240,000	US$ 75,000	US$ 58,000
Minimum Economic	US$ 800,000	US$ 300,000	US$ 200,000	US$ 85,000

4. Leather

Tanned leather and articles and garments manufactured from leather represent a medium promise opportunity. Before this opportunity can be implemented, the industry must constitute a program which will:

a. improve the quality of the hides;

b. utilize the idle capacity of existing tanneries and obtain technical assistance in the technology of tanning;

c. organize itself to produce and market leather in foreign countries.

Once a supply of good quality leather is assured, Bolivia will be in a position to manufacture, primarily for export, travel goods and fashion garments. Merchandising assitance will be essential to the success of this project, particularly that part dealing with fashing goods.

Another area that should be investigated is the possibility to manufacture products from the leather of llama, alpaca, and vicuña, for export to foreign countries.

5. Industrial Transmission Belting

Transmission belting manufactured from rubber may be manually "laid up" and vulcanized with a relatively small investment. A minimum viable would require about US$ 70,000 in sales per year and an investment of US$ 50,000. Such a plant would only be sufficiently large to supply Bolivian belting requirements.

In order to justify a minimum economic plant, however, pipe and tube would also have to be manufactured. The total sales required by a minimum economic plant would be about US$ 900,000; investment for equipment would be US$ 475,000.

Imports of transmission belting, pipe and tube into the Andean Subregion and LAFTA are approximately US$ 12.0 million and US$15.0 million, respectively. It is expected that plant manufacturing these three products could achieve sufficient penetration in the Andean and LAFTA markets to support a minimum economic plant.

6. Toys, Working Models, Parlor Games, and Dolls

This grouping and, in particular, toys and working models represents a medium promise opportunity. The imports of toys and working models are estimated to be US$ 300,000 in Bolivia and US$ 3.5 million in the Andean Subregion.

A minimum viable plant would require sales of US$ 200,000 to breakeven and equipment investment of US$ 175,000; the minimum economic plant would require sales of US$ 600,000 and an investment of US$ 250,000. As a result the market in Bolivia is sufficient to suppor a minimum viable plant. If nominal penetration were achieved on the Andean market a minimum economic plant could be supported.

7. Cameras, Photographic Equipment, Photographic Emulsions in the Form of Plates, Roll Film and Paper

Photographic emulsions in the form of plates, film, and paper in combination with cameras and apparatus represents a medium

promise opportunity. The manufacture of cameras and photographic materials can complement one another i a manner which can be highly profitable to the manufacturer.

IV. RECOMENDATIONS FOR FEASIBILITY AND PREFEASIBILITY STUDIES

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We have classified the opportunities identified in our analysis according to whether they should be investigated with a full feasibility study or a prefeasibility study. Full feasibility studies are generally undertaken when an opportunity survey is so strongly positive in its conclusions that it is apparent that an opportunity deserves to be implemented. In such circumstances the feasibility study is principally conducted to determine fairly precisely the magnitude and form of the project. Feasibility studies typically include the following:

- A description of the project
- An examination of markets
- An estimate of the optimum economic scale of plant and technology, given the market and resources
- The identification of the site most suitable for the project and suggestions as to alternative sites
- Detailed investment and operating cost estimates
- An analysis of the project's commercial viability
- An assessment of the effect of establishing the project on the national economy

A feasibility study also generally includes sufficient detail for it to be utilized as a basis for securing the financing required to implement the project.

Prefeasibility studies on the other hand, are conducted when uncertainty exists about one or two critical variables, which must be evaluated before conducting a feasibility study. These can be questions of adequacy of technology, raw materials, markets or other. Prefeasibility studies can also be conducted for procedural purposes. A specific example of the latter use might be the gathering of evidence required to demonstrate at the forthcoming meetings in Lima on the programming of specific sectors that a given industry should be situated in Bolivia. The content or scope of a prefeasibility study therefore, will differ according to the problems that one is attempting to solve.

The feasibility studies in each sector should include the following:

A) Non-Ferrous Metals

1. Tungsten
2. Copper
3. Ferro-Alloys
4. Non-Ferrous Alloys
5. Commercialization of Antimony, Bismuth, Tungsten, Non-Ferrous Alloys and Zinc.

B) Non-Metallic Minerals

1. Flat and Specialty Glass
2. Ceramic Tile

C) Chemicals

1. Titanium Dioxide
2. Lube Oil Additives
3. Xanthates
4. Sodium Cyanide
5. Soda Ash, Caustic Soda and Sodium Silicate

D) Forest Products

1. Specialty Papers
2. Plantation Production of Chinchona

E) Food Products

1. Beef
2. Animal Feed
3. Pyrethrum
4. Dairy Products

Prefeasibility studies should be conducted for the folowing:

A) Non-Metallic Minerals

1. Construction Industry
2. Grain Magnesite
3. Asbestos Fiber

B) Metal Working

1. Internal Combustion Engines
2. Hoists and Winches

3. Geodesic Instruments
4. Mining Equipment
5. Fans and Blowers
6. Tractors
7. Interchangeable Tools
8. Air Compressors and Blowers
9. Bearings
10. Pumps
11. Metal Working Machine Tools
12. Power Transmission Equipment
13. Sewing Machines
14. Leveling and Excavating Equipment
15. Food Machinery
16. Hand Tools
17. Wood and Plastic Working Machines Tools
18. Electromechanical Hand Tools with Motor for Manual Use
19. Non Electrical Motorized Hand Tools
20. Nuts and Bolts
21. Wire Rope and Cable
22. Hand Saws and Blades
23. Refrigerators
24. Industrial Ovens and Furnaces
25. Tubes and Pipes

C) Electrical Electronic

1. Electrical Motors and Transformers
2. Insulated Wire
3. Switchgear
4. Radio Receivers

D) Chemicals

1. Pharmaceuticals

E) Forest Products

1. Lumber Export to Argentina
2. Mahogany Export to the United States

F) Food Products

1. Vegetable Oil and Cake
2. Trout
3. Citrus Juices
4. Essential and Industial Vegetable Oils

G) Consumer Goods and Light Industrial Products

1. Motorcycles Including Motorbycicles
2. Wrist Watches, Including Pocket Watches
3. Toys and Working Models
4. Textiles and Garments Including Outergarments and Undergarments for Women, Girls, Infants, Men, and Boys
5. Leather Apparel and Leather Travel Goods
6. Transmission Belting and Other Rubber Articles.