Technologies To Support Alternative Crop Production

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Whatever the product, supporting technologies are needed to enable producers to compete in global markets. Key needs in the Andean region, include:

- Research, extension, and access to technologies that can improve production of commodities;
- Processing, transport, handling, storage, and communication infrastructure; and
- Improvements in product quantity and quality and trade programs to increase competitiveness of Andean products.

Meeting these needs is the ultimate challenge facing national and international development organizations.

INTRODUCTION

Research and extension plays an enormous role in providing alternative livelihoods for coca producers and promoting their adoption. Development of suitable technology packages for coca farmers will depend in large part on the ability of research and extension specialists to conduct interdisciplinary and adaptive work. Existing research and extension systems are not well-equipped to fulfill this role and economic disparities and political conditions restrict the level of national funding for these efforts. Technology transfer can provide assistance in this arena, but improvements are needed.


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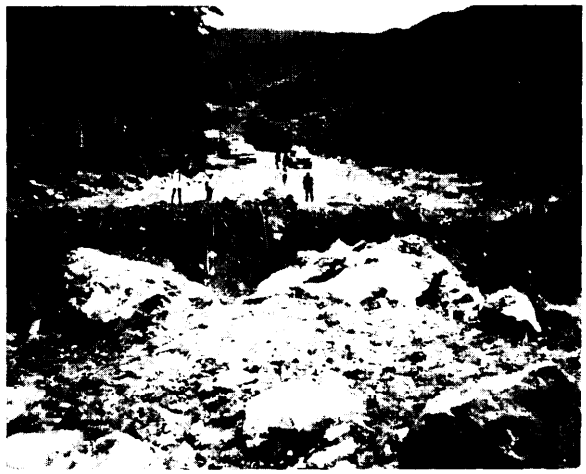
Adequate infrastructure (including processing and storage facilities, tyransportation pathways and vehicles, and communication pathways) is critical in supporting production and marketing of Andean products. Ability to move necessary inputs into producing regions and raw or processed materials out to wider

markets depends on effective, affordable transportation. Information on markets and prices is necessary for practitioners to make production decisions. Currently, agricultural marketing is hindered by the lack of: specialized packing facilities; cooling facilities; airport-based cool storage; ability to load refrigerated shipping containers at product source; and specialized processing installations nearby production areas. Private-sector investment in supporting production and marketing is hindered by the lack of affordable credit, and government inability to service international loans hinders national investment in comprehensive roads and other services or in sizable construction projects.

Infrastructure development—particularly transportation systems—is controversial. Some argue such development will assist narcotics traffickers and others cite the disastrous environmental consequences of some early road-building projects in the Amazon region. Nevertheless, while it is *possible* that improved infrastructure would benefit narcotics traffickers, it is *certain* that producers of legitimate products are handicapped by its absence.

Production of alternative crops is not yet at a level where Andean producers can enter international markets effectively—small production units make product quantity a key constraint to effective competition. There is a need for importers willing to accept small shipments with a vision towards expansion as producer capability and production area increase. Marketing agricultural products also can be complicated by the strict product quality and safety requirements of importing nations. Such restrictions can be difficult for developing countries to meet without proper training and assistance programs. Trade programs that stimulate Andean exports to the United States and other countries can complement alternative development efforts. For example, the Andean Trade Initiative (ATI) offers specialized trade arrangements for the Andean nations with the United States. This action addresses the need in part, but greater effort is likely to be necessary.



DOUGLAS POOL, DEVELOPMENT ALTERNATIVES, INC.

Reliable roads are essential for profitable agriculture in the Andean region. Here, heavy rains have washed out a road in the Chapare, Bolivia, disrupting farmer access to agricultural inputs, markets, and agricultural extension.

ANDEAN AGRICULTURAL RESEARCH AND EXTENSION SYSTEMS

Bolivia, Peru, and Colombia possess the essential institutional foundations to develop effective national research and extension systems. However, each country has a unique situation and must overcome certain problems evident in existing systems. Proper action to improve the functioning of research and extension is a basic condition for future agricultural success. All three countries require foreign financial aid and/or specialized technical assistance. Peru requires financial aid urgently to rebuild its system. In Bolivia, the need for technical assistance probably is more acute.

Whatever the amount and quality of technical and financial assistance granted to the affected

[1] The information contained in this section was drawn largely from A. Chavez, "Andean Agricultural Research and Extension Systems and Technology Transfer Activities: Potential Mechanisms To Enhance Crop Substitution Efforts in Bolivia, Colombia, and Peru," contractor report prepared for the Office of Technology Assessment, December 1991.

countries, its usefulness will depend on actual measures taken by governments to secure permanency and progress for research and extension agencies and their programs. A real and effective political commitment to technical innovation and modernization of agriculture must be made, particularly in Bolivia and Peru, including adequate funding for research and extension activities, respectable salaries for personnel, and appropriate regard for the entities in charge of these activities.

Agricultural research and extension systems vary significantly among Bolivia, Peru, and Colombia. Funding levels, staff size and capability, and institutional arrangements comprise key differences. Government instability has constrained agricultural modernization in Bolivia and Peru where the research and extension systems are under central government control. Colombia's system has been participatory and stable, with an obvious direction toward modern agriculture.

Agricultural research and extension systems typically are based on national research organizations, agricultural colleges, and private nongovernmental organizations. Regional political pressures in Bolivia and a strong private sector in Colombia influenced diversification of their respective research systems, while the Peruvian system has remained unchanged. A review of institutional frameworks and resources highlights the importance of foreign assistance and international cooperation in promoting Andean research and extension systems.

Bolivia

INSTITUTIONAL FRAMEWORK

Bolivia's agricultural research system has four main components established in the 1970s that conduct basic and applied research and provide extension services to most agricultural producers:

. Bolivian Institute of Agriculture and Livestock Technology *(Instituto Boliviano de Tecnologla Agropecuaria* (IBTA))--IBTA is the leading national research institute, and its subcomponent the IBTA-Chapare, is the main research and extension agency for Bolivia's coca substitution program.
- Tropical Agriculture Research Center (Centro *de Investigación Agrícola Tropical* (CIAT)) --CIAT is a regional research agency for Santa Cruz, the country's most dynamic agricultural sector.
- Pairumani Plant Genetics Research Center *(Centro de Investigaciones Fitogenéticas de Pairumani (Santa Cruz)* (CIFP))-CIFP is a technical branch of the Patino foundations,
- Bolivian Institute of Science and Nuclear Technology *(Instituto Boliviano de Ciencia y Tecnología Nuclear (IBTN))--IBTN* focuses on chemical analysis and tissue culture.

In addition to these organizations, several Department development corporations *(Corporaciones Departmentales de Desarrollo),* universities, and nongovernmental organizations (NGOS) perform agricultural research on short-term, specific problems for local clientele. However, little coordination exists among the formal research and extension system and these groups,

IBTA direction is determined by the Ministry of Agriculture (MACA--an organizational structure that has created substantial difficulties for IBTA. Politically-oriented changes in Directors and research priorities have fragmented IBTA's meager financial resources. The Government of Bolivia's investment in agricultural research through IBTA has declined, resulting in manpower reduction policies and complete reliance on foreign assistance.

IBTA research is commodity-oriented and geographically restricted to the Altiplano and Valley areas. IBTA operates three experiment stations, three substations, and two germplasm centers, all poorly equipped and staffed. Research conducted by IBTA will continue to focus on genetic improvement and field management of commodities in the Altiplano and Valley regions.

IBTA was responsible for Bolivia's extension service, operating seven regional offices with a total of 80 extension posts. The national extension system failed, however, due to poor coordination with other research agencies, poorly paid and inadequately trained staff, and lack of well-established extension methodologies and monitoring and evaluation methods.

IBTA-Chapare operates under the Regional Alternative Development Project *(Proyecto de Desarrollo Alternative Regional* (PDAR)), and carries out research and extension activities for Bolivia's coca substitution program. IBTA-Chapare operates two experiment stations: La Jota—for research on crops, soils, and pest control; and Chipiriri--for research on livestock and poultry. In addition, IBTA-Chapare undertakes many studies, and extension[2] and promotional activities through NGOS and other regional entities. It also maintains close technical relationships with several national and international research entities.

Centro de Investigació Agrícola Tropical has a regional research focus on production systems in Santa Cruz emphasizing grains, tree crops, and livestock. CIAT also performs research in rhizobiology, fertilizer management, and postharvest problems. Research programs of the *Universidad Autónoma "Gabriel Rene Moreno,"* which concentrate on beans, corn, and cassava, complement CIAT activities. Additional activities include horticulture research at the Okinawa Experiment Station and sugarcane research at the Sugarcane Producers Association Experiment Station.

CIAT receives national and international funding to carry out its research and extension activities. Domestic funding ($1.6 million annually) primarily comes from regional public entities and local producer associations. External financial assistance comes from seven international donors. CIAT is managed by a Board 01 Directors under an Executive Director appointed by the Minister of Agriculture for a 5-year term.


WORLD BANK

Irrigation networks can be important supporting infrastructure for regions experiencing a dry season. IBTA-Chapare research on improving agricultural production in the High Valleys includes an irrigation component.

A Regional Research Council meets twice a year to coordinate research activities in Santa Cruz.

The *Centro de Investigaciones Fitogenéticas de Pairumani* focuses its research efforts on developing new varieties of grain legumes, maize, and wheat. Most of its research is done in Cochabamba. Although CIFP has a significantly smaller annual budget than some of the other institutions, it has been successful in genetic improvement of maize for silage, and development of some new maize varieties for human consumption.

The *Instituto Boliviano de Ciencia y Tecnolo - gía Nuclear* recently began to address agricultural matters in its chemical analysis and tissue culture work. These areas of expertise allow IBTN to complement IBTA research in soil-water relationships, soil fertility, and high-altitude cropping systems.

RESEARCH AND EXTENSION PRIORITIES

Bolivian near-term agricultural policy goals include: 1) improving rural economies, 2) increasing food production, 3) integrating the

[2] Extension activities include 87 demonstration production units reaching more than 7,000 producers.

agricultural economy with international markets, 4) promoting agricultural exports with competitive advantages, 5) developing and implementing sustainable agricultural systems, and 6) improving crop substitution activities (18). A national council *(Consejo Nacional de Investigación y Extensión Agropecuaria---CNIEA)* directs Bolivian research and extension activities to achieve national agricultural goals. CNIEA is headed by the Deputy Secretary of Agricultural Production and includes representatives from major public and private entities that conduct research and extension. Although all agencies involved in research and extension continue to pursue individual agendas, CNIEA can play a critical coordination role in Bolivian agriculture.

A major priority is to rebuild a national extension service. This has been accomplished partially through regional and local systems and international donors through their agricultural development projects (e.g., Cochabamba Regional Development Project). An estimated 130 NGOS are active in extension and reach between 100,000 and 150,000 small farmers-roughly one-third of the national farm population (37). Some Department development corporations also provide extension services through regional or local agricultural projects. Finally, a growing number of farmer cooperatives and commercial firms provide extension assistance and information to farmers.

Ideally, research priorities are set according to local or regional conditions and actual production problems and patterns. Involving farmers and producer organizations can be key in setting realistic research and extension priorities. These groups can assist in identifying primary production problems. For example, CIAT research priorities closely reflect local agricultural problems in Santa Cruz. The close relationship between CIAT and local farmer associations and extension specialists fosters such applied priority setting. Conversely, lack of farmer representation in IBTA-Chapare and lack of transitional production systems may have constrained priority setting in connection with coca substitution activities.

IMPROVING EXISTING RESEARCH AND EXTENSION SYSTEMS

Agriculture is beginning to be revitalized to supply domestic markets at reasonable prices and expand and diversify exports. Accordingly, much attention is focused on Bolivia's agricultural research and extension system. International financial and technical support, and specific commodity projects by different research and extension agencies represent important contributions to Bolivian agricultural development.

A need exists for enhanced coordination among institutions within the system such that national and regional research priorities can be established and institutional research plans harmonized. An improved relationship between research and extension is also needed to enhance technical assistance to farmers and to keep research relevant to their needs. Also necessary are attention to agricultural regions that lack research and extension services and comprehensive training in the skills and expertise needed to modernize Bolivian agriculture.

Peru

INSTITUTIONAL FRAMEWORK

Agricultural research and extension activities in Peru have been provided almost exclusively by central government institutions. Accordingly, these institutions have been characterized by instability. Over the last two decades, institutional structures and responsibilities for research and extension have changed frequently due largely to political changes. The current political flux of Peru may result in further alterations of the existing research and extension systems.

National crop, forestry, livestock, and agroindustry research are the responsibility of the National Institute for Agrarian and Agroindustry Research *(Instituto Nacional de Investigación Agraria y Agroindustria!* (INIAA)) established in

1987, while extension activities have been placed under regional governments. Most of these units are ill-equipped for extension activities and currently the system barely operates. Another reorganization is planned to give extension responsibilities to the INIAA.

Peruvian universities rarely are involved in providing research for government or private institutions; most university research activity is confined to student thesis work. Exceptions to this situation are the National University of San Marcos Graduate School *(Universidad Nacional Mayor de San Marcos* (UNMSM)) and the National Agrarian University *(Universidad Nacional Agraria* (UNA)) at Lima. UNMSM has made major contributions related to animal health and livestock production systems. UNA, the most important academic center for agricultural and biological sciences in Peru, has managed to develop and maintain a highly qualified cadre of agricultural professionals since the 1960s. Foreign investment and institution-building efforts have fostered UNA'S position as a key contributor to agricultural development.

General financial and political crises that have ravaged the university system since the 1970s have adversely affected UNA, however, and its academic quality and research potential have declined. Tropical forestry research on species inventory and on tropical woods characterization for industrial uses is one of the few research fields that UNA has pursued continuously. Four universities at Tingo Maria, Tarapoto, Iquitos, and Pucallpa, cover Amazonian ecosystems, but their research capabilities are very limited.

The Peruvian Amazon Research Institute *(lnstituto de Investigaciones de la Amazonía Peruana* (IIAP)) was created to promote and coordinate research in the Amazon region. IIAP has few technical and financial resources, however, and thus its activity and power fall far short of its chartered mandate. Currently, the only vehicle for research coordination in Peru is the Peruvian Amazon Research Network *(Red de Investigación de la Amazonía Peruana* (REPAP)), an International Research Center for Development *(Centro International de Investigaciones para el Desarrollo* (CIID))-funded research network established in 1989 to develop sustainable production systems for the Amazon region.

Research and extension funding has diminished significantly over the last 5 years and recent budgets have provided only for payroll and not operating expenses. Thus, most technical personnel sit idle; the few ongoing research activities are totally dependent on foreign interests and funding. The public extension system has declined in importance as nonpublic organizations (e.g., national and local commodity organizations, universities and technical institutes, and the commercial sector) began to provide extension services. However, these services tend to address specific needs in the most favored agricultural areas rather than possessing a broader national agricultural agenda. The government has not made any systematic effort to organize or extend these alternative extension services nationally. Thus, most Peruvian farmers lack systematic and permanent technical support.

Institutional instability, unrealistic salary policies, and political maneuvering have constrained attempts to establish permanent professional research and extension teams in Peru. In fact, government actions have reduced the number of public research and extension personnel. INIAA's professional staff has been reduced already by 40 percent (around 200 positions).

PRIORITIES FOR AGRICULTURAL RESEARCH AND EXTENSION

Research and extension were neglected during the late 1960s and throughout the 1970's (16) as resources were directed to irrigation projects and land reform. During the 1980s, government interest and investment in research and extension improved substantially with financing from the World Bank, U.S. Agency for International Development (AID), and the InterAmerican Development Bank (IDB). Even then, total public investment in agricultural technical change re-

mained small. Today, Peru's agricultural structure is based on *minifundia-small* landholdings—with 72 percent of units smaller than 5 hectares (approximately 12.5 acres). Undoubtedly, this will present great challenges to research and extension.

Economic policies promoting low-priced basic food imports since the 1960s have adversely affected domestic food production. A widening gap between domestic supply of and demand for basic foods led to prioritization of research programs on rice, maize, potatoes, grain legumes, and wheat. During the second half of the 1980's, the number of research programs expanded as demand for work on other products grew. Research in oilseeds, horticulture, fruits, soil and water management, forestry, and agroindustry were added to the agenda. However, increases in funding did not accompany the expanded agenda of research and extension institutions. In recent years, agricultural priorities have shifted from domestic to export markets.

Extension priority was given to the northern coast and the most important Andean valleys. In the Amazon region, only the big valleys of the northeast received some support. The Andean highlands, with the largest and poorest peasant population, and new agricultural areas in the Amazonian region, remained almost unattended,

IMPROVING RESEARCH AND EXTENSION SYSTEMS

The key constraints to improving the agricultural research system in Peru revolve around the lack of a functional national extension service, poor coordination of activities, and low funding levels. The impulse given to agricultural research and extension during the first half of the 1980s lost steam as economic and political difficulties increased. The number of international donors decreased, which in turn has resulted in redistribution of existing outside funding. The sectoral project supported by IDB came to an end in 1986 and the World Bank stopped disbursing in 1987. AID's financial support continued, but had to be redistributed among a growing number of research programs and to all experiment stations. The situation continues to decline with most experiment stations being transferred to regional governments or the private sector, The majority of these organizations do not have the financial means or the technical expertise to manage research.

Colombia

INSTITUTIONAL FRAMEWORK

International assistance has been very important to the Colombian research and extension systems. During the 1960s, most foreign assistance was from the United States, and focused on institution building. In 1963, the Ford, Rockefeller, and Kellogg Foundations played critical roles in the organization and implementation of research and extension programs. By the end of the 1960s, 18 international agencies were cooperating with the Colombian Agricultural Institute *(Instituto Colombian Agropecuario* (ICA))----the most important agricultural research institution in Colombia. ICA was created in 1962 as part of the government restructuring of the public agricultural sector and has been the most important source of technical and financial assistance to agricultural producers. The Institute maintains a large, highly trained staff to provide a broad and diverse human-resource base for agricultural research and extension. This may be the most important single factor contributing to modernization of Colombian agriculture. Key factors in ICA'S success were government financial and political commitment to research and extension, and the involvement of the private sector and key public agencies (13).

ICA has been instrumental in promoting the use of modern agricultural techniques in Colombia. Improved cultivars and practices are now used on nearly 40 percent of Colombian cropland. The Institute supplies most of the basic seed used for agricultural production and is active in devel-

oping improved varieties. For example, ICA released 236 new varieties and cultivars of the country's most important crops, 34 of them between 1986 and 1990.

ICA'S institutional framework for research and extension includes 4 national research centers, 12 regional research centers, 7 experiment stations, 29 diagnostic centers for animal health, and a network of 66 regional centers for extension, training, and technology dissemination. Training is a high priority for ICA. Between 1986 and 1990, ICA spent $7.7 million, or 6 percent of its total budget, for training. About 35 percent of ICA'S budget supports direct research and extension activities (15 and 20 percent, respectively) (14).

Government support for research and extension has accounted for 55 to 75 percent of ICA'S budget. Government contributions grew steadily between 1964 and 1990, but currently are decreasing. With fewer financial resources and numerous loan repayment obligations, ICA is looking for avenues to increase income. Possibilities include increasing competition with the private sector.

Colombia also has a complex network of private institutions in the agricultural sector. The private sector has expanded its role in genetic and agronomic research as well as in certified seed production. In the 1980s, significant private research effort was placed on sugar cane and coffee. Oil-palm producers recently have organized a research center (CENIPALMA), and flower and banana producers are planning their own research centers. Benefits for producers could be achieved through a vigorous coordination effort among the numerous private and public research and extension institutions.

Private-sector support of university research has improved capabilities of the Agronomy Department and the Graduate School of Colombia's National University. However, the majority of Colombia's universities do not play important roles in agricultural research or extension. Despite Colombia's strong institutional framework for agricultural research and extension, productivity improvements are hampered by financial instability for exports (due to an overvalued Colombian peso), lack of security in many agricultural regions, institutional confusion, and lack of coordination.

Colombia is now in the process of decentralizing public functions and responsibilities. Agricultural extension will become the responsibility of Municipal Units of Technical Assistance *(Unidades Municipales de Asistencia Técnica Agropecuaria* (UMATAS)). Tax revenues will be transferred to the UMATAS for rural development. The Integrated Rural Development Fund *(Fondo de Desarrollo Rural Integrado* (DRI)) is implementing a strategy for local agricultural development working through the UMATAS. At the same time, a compromise between centralized and decentralized approaches to extension is emerging in the National System of Technical Assistance for Small Producers *(Sistema Nacional de Transferencia de Technología Agropecuaria* (SINTAP)). SINTAP will focus on small producers and development of local production options. Local extension priorities will be set by the UMATAS. Finally, ICA is preparing a set of local, regional and national agricultural projects.

PRIORITIES FOR AGRICULTURAL RESEARCH AND EXTENSION

The Alta and the Media Guajira (1.7 million hectares), and parts of the Orinoquia region (2.1 million hectares farmland and 13 million hectares grassland) have been identfied as high productivity zones, which should be prioritized for research. Research priorities by topic include:

- Agricultural production in acid soils,
- Low-cost production systems for Andean valleys, and
- Biotechnology.

Production option priorities are not clear and, in general, insufficient attention is given to prioritizing the research use of public resources. ICA, perhaps due to its large size, is finding it difficult to focus on research subjects consistent with the

Box 5-A–Necessary Conditions for Successful Technology Transfer

1. **Technology should fit the local biophysical and** socioeconomic environment of the adopters and should have proven successful elsewhere under similar conditions, at least on a pilot scale.
2. **Technology is transferred most effectively by direct people-to-people actions** involving individuals with experience in applying the technology. Media presentations (e.g., pamphlets, books, radio) may assist, but personal interactions are necessary.
3. Technology transfer agents must be well-qualified and experienced in applying the technology and able to communicate effectively to potential adopters. Development of expertise in local organizations is necessary to continue technology transfer beyond the bounds of development assistance projects and time frames.
4. Facilitators or middlemen are needed in addition to transfer agents and capable adopters to help new technologies compete with established resource use methods.
5. Adopters andtransferagents should **be involved in choosing,** planning, **and implementing** technology transfer so that it will meet actual needs and is appropriate to the setting in which it will be implemented.
6. Interests of all parties involved **in technology** transfer should be identified and addressed **in the technology** transfer effort; all must see how the technology will benefit them.
7. Early definition of participant roles is needed so that all are aware of the subsequent steps in the transfer process and the relationship between their actions and those steps.
8. Demonstrations of the technology should take place under environmental, economic, and **sociocultural** conditions similar to those where it will ultimately be implemented.
9. Commitment of financial resources should be sufficient to carry out the technology transfer until it is self-supporting.
10. The transfer process must indude mechanisms through which all participants can contribute effectively to interim evaluations and adaptations.

SOURCE: Derived from a Technology Transfer Workshop held for the Office of Technology Assessment study of *Technologies* to *Sustain Tropical* ***Forest Resources*, OTA-F-214 (Washington, DC: U.S. Government Printing Office, March 1984).**

regionalization process. Demands from the local extension systems and the growing involvement of the private sector in research further complicate this task. Several observers and public officials propose focusing ICA research on basic crops, small-farming production systems, and natural resource management.

IMPROVING RESEARCH AND EXTENSION SYSTEMS

Colombia's political and economic system is in flux. The new constitutional rules and the macroeconomic policies of the Colombian *aperatura* may create opportunities for social and economic development. However, institutional adjustment to these new conditions could be difficult. The size and role of national research and extension institutions are likely to change as fiscal support funds dwindle and local, regional, and private-sector entities begin to replace them. ICA in particular has had difficulties prioritizing effectively in light of expanding responsibilities. Reduced government financial contributions and debt repayment obligations may exacerbate these difficulties. Conversely, extension funding does not seem to be a problem. The SINTAP project alone is likely to provide a significant amount to extension (nearly $130 million). The central government is providing value-added tax revenues for extension activities through the UMATAs. Private-sector institutions can and are willing to play an important role in promoting technical innovation in agriculture, in some cases through research contracts with universities. The government then could concentrate its efforts on small producers and improving rural economies.

Box 5-B-Horizontal Cooperation for Agricultural Research and Extension

Technology transfer among Latin American countries can link regions with similar environmental conditions and promote research and development of suitable technologies. For example, PROCITROPICOS, a cooperative agreement recently signed by a number of national agencies for agricultural research (NAARs) of Latin American countries, is focusing on cooperative or joint research programs, scientific and technical information exchange, and technology transfer. Efforts will be devoted to three main tropical ecosystems (i.e., humid-tropic, tropical savanna, and Amazon highlands) common to Bolivia, Brazil, Colombia, Guyana, Peru, Suriname, and Venezuela The PROCITROPICOS will be supported by the Inter-American Institution for Cooperation on Agriculture (IICA) of the Organization of American States. Programs and activities of PROCITROPICOS should contribute to policy formulation and determination of production options conducive to sustainable development in the tropics. Sustainability criteria for the Latin American tropics and practical measures and actions for achieving sustainable production systems will be a main research focus (PROCITROPICOS Agreement, 1990).

Another cooperative program for research and technology transfer among Andean countries, PROCIANDINO, was initiated in 1985 by IICA and the InterAmerican Development Bank. The participant NAARs are from Bolivia, Colombia, Ecuador, Peru, and Venezuela and the program is governed by a council of NAAR directors. The program includes two major activities: joint research by two or more participants on specific problems that affect production of selected commodities; and horizontal technology transfer through atraining program and experts consultation. PROCIANDINO initially focused on potatoes, maize, grain-legumes, and extension methods, and recently has expanded to include crop and livestock production problems in the Andean region. PROCIANDINO generally is praised as an effective mechanism for horizontal cooperation although delays in financing operating expenses and equipment purchases have hampered the research component. Through this project, scores of technicians and professionals from the NAARs have been able to experience and observe different ways of solving common problems.

SOURCE: A. Chavez, "Andean Agricultural Research and Extension Systems and Technology Transfer Activities: Potential Mechanisms to Enhance Crop Substitution Efforts in Bolivia, Colombia, and Peru," contractor report prepared for the Office of Technology Assessment, December 1991.

Agricultural Technology Transfer

Technology transfer is a temporary activity and provides a mechanism to build local expertise throughout the technology development and diffusion process (box 5-A). Activities that are conceptualized and implemented such that a long-term professional partnership is established between native and foreign experts may be most successful. Project cycles of at least 10 years probably are necessary to produce relevant results spanning technology generation to technology adoption by the average producer. Examples include the joint programs established by International Agricultural Research Centers (IARCS) and specific financing sources (e.g., the Trop-Soils and the Small-Ruminants programs in Peru) or bilateral assistance groups (e.g., AID Seed program in Bolivia). Development of local abilities in this way increases the potential for continuation of efforts after foreign assistance has ended. Regional technology transfer activities also have proven to be very useful. Collaborative research programs among Latin American countries (box 5-B) could be enhanced organizationally and financially and used more intensively.

In the early 1970s, key Bolivian national research groups (e.g., IBTA and CIAT) were created under U.S. technology transfer programs. Today, a number of bilateral and multilateral assistance organizations provide a wide array of technical expertise. CIAT in Santa Cruz is working with British, Japanese, and Dutch donors, and foreign consultants comprise a large part of CIAT's technicians (box 5-C). While some difficulties exist with donor coordination, this may be addressed with the establishment of CNIEA to

facilitate and coordinate national planning for development. World Bank projects to integrate public and private-sector development efforts could increase professional and economic security in the research system. These stabilization measures are likely to improve the effectiveness of technology transfer activities and increase their long-term contribution to Bolivian agriculture.

In Peru, technology transfer activities contributed heavily to establishing the research and extension programs and helping to train Peruvian researchers that became the technical core of INIAA's research programs. Responsibility for technology transfer currently is being shifted from central government institutions to regional governments. Privatization of public functions and activities is gaining momentum, but where this trend will take Peru's technology transfer system is unclear. Peru has developed a relatively extended and well-qualified human-resource base through cooperation with international donors (box 5-D). However, institutional instability and erratic salary policies have eroded this base considerably and security problems reduce Peru's ability to receive and handle technology transfer projects effectively. These difficulties must be addressed to improve training efforts, consolidate key institutions, and maximize technology transfer benefits.

Technology transfer and financial assistance have been integral parts of the Colombian research system. Technology transfer contributed significantly to improved product quality control when the Colombian private sector initiated a strong drive to increase agricultural exports in the 1970s (primarily coffee, cut flowers, and bananas). Financial assistance in connection with technology transfer activities similarly has been important for national institutions. From 1979 to 1984, technology transfer projects brought approximately $5 million in grant money to the ICA and in 1986, ICA held nearly 200 technology transfer agreements with 30 different foreign entities (14) (box 5-E). Technology transfer has greatly diversified ICA's research agenda, although there is some indication that this may have operated to the detriment of the institution (e.g., by increasing responsibility beyond institutional capacity).

Increasing agricultural productivity and profitability will be critical to support crop substitution approaches as part of a long-term strategy to

Box 5-C–Bolivian Seeds Project

One of the most fruitful technology transfer experiences in Bolivia, and one that carried important lessons for other developing countries, was the Seeds Project (Project T-059), initiated at the end of the 1970s with AID funding. The underlying concept was that properly organized and trained producers could succeed. Thus, the main project strategies of technical assistance and financial support for seed production infrastructure were revised to focus more on producer organizations and training. Technical support was given to a public office (MACA—Departmento de Semillas) and financial support was given to upgrade public-sector seed plants that were operating at very low capacities. The project advisor was based in Santa Cruz instead of La Paz where the project benefited from liberal ideas of local agricultural leaders and restricted national government ability to dominate the project. From Santa Cruz, the project expanded to El Chaco, Chuquisaca, to part of Tarija.

Producer participation was significant, particularly in the training activities and several small- to medium-sized seed enterprises were organized. Increasing numbers of institutions and producers became involved in t he new production and marketing activities. For instance, the experiment stations became specialized producers of foundation seed. The project triggered a qualitative change in the local farmers' technical environment and promoted the institutional structure needed by a modern seed industry. Commercial demand for certified seed experienced tremendous growth, from 200 metric tons in 1970 to more than 10,000 metric tons in 1988 with a continuing growth trend.

SOURCE: A. Chavez, "Andean Agricultural Research and Extension Systems and Technology Transfer Activities: Potential Mechanisms to Enhance Crop Substitution Efforts in Bolivia, Colombia, and Peru," contractor report prepared for the Office of Technology Assessment, December 1991.

Box 5-D-Collaborative Technology Transfer Efforts in Peru

The Trop-Soils and Small-Ruminants collaborative programs are examples of long-term technology transfer activities. The Trop-Soils program, focusing on problems of tropical soils of the Amazon region, involved a team of Peruvian professionals and technicians working full-time with foreign scientists. The effort has resulted in a number of important contributions in productive, economically efficient, and ecologically sustainable soil management technologies. The program also has a successful training component; helping young Peruvian scientists in graduate studies and providing hands-on training in specialized tasks for laboratory and field technicians. The Trop-Soils program has been in operation for nearly 12 years, although security concerns have had an adverse impact on the level of activities at the Yurimaguas experiment station.

The Small-Ruminants program, focusing on native cameloid stock, is now in its 1 lth year. This effort also has been an important and useful experience for Peruvian research. In addition to National Institute for Agrarian and Agroindustry Research (INIAA) and Institute for Tropical and High Altitude Veterinary Research (IVITA), the leading Peruvian partners, the program involved several regional universities, cameloid production units, and an array of Peruvian professionals and scientists. The program trained 90 Peruvian professionals seeking advanced degrees, and generated about 700 publications. These two results are probably the program's most useful contributions to research in this field and to the diffusion of technical knowledge to producers.

SOURCE: A. Chavez, "Andean Agricultural Research and Extension Systems and Technology Transfer Activities: Potential Mechanisms to Enhance Crop Substitution Efforts in Bolivia, Colombia, and Peru," contractor report prepared for the Office of Technology Assessment, December 1991.

reduce coca cultivation. Most coca production occurs in areas characterized by low land-productivity and poverty. Research, extension, and technology transfer efforts can work to develop packages of practices suitable to these regions. A comprehensive crop-substitution strategy is likely to require:

- Enhanced research and extension activities,
- Financial assistance for research and extension,
- Foreign expertise to share professional research and extension responsibilities on a long-term basis, and
- Enhanced cooperation among Latin American countries.

Several issues that should be addressed jointly by research and extension specialists to improve technology transfer include: improved communication among researchers, extension agents, and producers; prioritization of technology dissemination efforts; and adaptation of extension methods to local conditions. External reviews and evaluations have identified research areas deserving of future attention, and point to new opportunities to improve technology transfer activities. In general, greater attention toward natural resource management is needed as well as refocusing crop research to include cultivation practices, integrated management of pests and diseases, and postharvest problems. A multidisciplinary approach and close cooperation with specialized international programs and research centers will be needed to achieve these goals.

INFRASTRUCTURE TO SUPPORT AGRICULTURAL PRODUCTION AND MARKETING

Processing, handling, and storage facilities and transportation and communication networks are critical needs for successful alternative development. Alternative crops must compete with an easily produced, processed, and transported commodity-coca-with a known and largely stable market. Producers need information on legitimate crop markets for production decisions, easily available and affordable inputs, and scheduled and reliable transport services. Lack of attention to transport and communication development

Box 5-E–The Panela Project

The Dutch-supported Panela project, initiated in 1983 in Colombia, is an excellent example of successful technology transfer. Panda-cane, a small farmer's crop, is a popular sugar substitute in many villages and rural areas, as well as an important ingredient in traditional Latin American dishes, The panela industry provides employment and a year-round income to many peasant families throughout the Colombian valleys and Piedmonte area

Project goals were to improve panela-cane varieties and cultivation methods and to improve traditional panela processing plants and methods. The Instituto Colombiano Agropecuario (iCA) established a pilot center in Santander (Barbosa) to promote adoption of the new technologies and results have been very promising. A new panela-cane variety has generated yield increases by as much as 30 percent.

The project also has produced technical recommendations for improving harvest efficiency and transport to mills. At the mills, new mechanical and chemical methods for cleaning juices were introduced, bringing extraction efficiency to 70 percent—a significant rise for a small-scale industry. Purity of juices also has improved. Finally, the project increased the efficiency of cookers and established the use of milled cane residual as fuel.

There are several important aspects of the Panela-project that made it a successful technology transfer experience. it addressed an important social and economic sector; changes and innovations in techniques and equipment were progressive and locally developed; and finally, the project had a long-term planning perspective-basic diagnosis and prioritization of problems ied to application and extension of solutions. At present, ICA is extending the achievements of the Panela project with the involvement of nine Centros Regionales de Capacitación, Extensión, y Difusión de Tecnología (CRECEDs) and several nongovernmental organizations.

SOURCE: A. Chavez, "Andean Agricultural Research and Extension Systems and Technology Transfer Activities: Potential Mechanisms to Enhance Crop Substitution Efforta in Bolivia, Colombia, and Peru," contractor report prepared for the Office of Technology Assessment, December 1991.

compounds the comparative disadvantage for producers of legitimate crops in remote areas by increasing costs above competitive levels (box 5-F).

Despite the clear need for infrastructural support for alternative crops, constraints to development include:

- Insufficient financing and credit mechanisms,
- Difficult environments for building physical infrastructure,
- Small and dispersed production units complicating facility siting, and
- Tenuous security in some production areas.

In addition, the potential for efforts to benefit coca production and cocaine trafficking reduces interest in infrastructure development. Nevertheless, adequate infrastructure will be necessary to improve opportunities for coca farmers to undertake alternative crop production.

Value-Added Processing Opportunities[3]

Preservation and processing techniques can increase storage life and quality, minimize wastage and spoilage, and facilitate shipping and marketing of agricultural products. Processing also may increase value for producers and market demand. Efforts to develop value-added processing in the Andean region are ongoing, although they have met with some difficulties. In most cases appropriate technologies exist, but the facilities are lacking. In addition, inadequate or lack of electrical distribution networks in producing areas is another significant problem.

3 The information contained in this section was drawn largely from B. McD. Stevenson, "Post-Harvest Technologies to Improve Agricultural Profitability,' contractor report prepared for the Office of Technology Assessment, May 1992.

KEVIN HEALY, INTERAMERICAN FOUNDATION

Simple techniques can be used for primary processing of some tropical food products. Here, cocoa is being sundried; the intermediate product will be packed and shipped to another cooperative facility.

An essential part of the analysis of any value-added proposal is quantifying raw material availability, processing costs, and current market prices for the transformed product. The latter information is more readily available than the former. International commodity markets are transparent in the sense that there are many information systems, including the commodities exchange reports from major trading countries. It is important that the Andean counties have access to this information. Subscription to information services on a regular basis could be a part of alternative development projects to address this need.

A variety of Andean tropical food products are suitable for processing for domestic and international markets. Tropical fruits can be juiced, aseptically packed, frozen, canned or dried. While none of these options currently are available in the Chapare in Bolivia, canning facilities are available in Cochabamba and Santa Cruz, and conventional juice extraction plants are also available in Cochabamba. Investment in processing opportunities in the production zone could reduce transport costs and improve product competitiveness.

Box 5-F—From Production to Market: Development Dilemma

Although difficult, identifying potential alternative crops is simpler than developing the industrial base to make the crop economically sustainable. The problem can be illustrated using a real example from the Chapare region. Maracuya (passion fruit) has demonstrated good production characteristics under small farm conditions. The fruit has been processed 100ally and international buyers have expressed enthusiasm for the single strength juice extract, such that an order was placed for approximately 18 tons of product, to be shipped in 55 gallon drums, frozen. At present total production in the Chapare is unlikely to exceed this quantity per year. However, freezing facilities are not in place, and due in part to high transport, processing, and handling costs, the product is costing approximately 50 percent more than that from competitive sources.

Each of these factors can be addressed within the context of Cochabamba Regional Development Project (CORDEP), but making the transition from supplying 100al market to that of exporting will require investment in plant material, extension effort to expand the production base, increased efficiency in processing, establishment of frozen goods transport systems, and reduction of transport costs that currently reflect the distance of the production area from the nearest seaport in Arica, northern Chile. Thus, the problem becomes less one of marketing and more one of production and infrastructure. This is typical of a number of products with which alternative development programs are working. There is insufficient raw material to begin an agroindustrial operation, except wit h multilevel investment starting with the expansion of the production base.

SOURCE: B. McD. Stevenson, "Post-Harvest Technologies to Improve Agricultural Profitabilityr" contractor report prepared for the Office of Technology Assessment, May 1992.

Similarly, nut crops can be harvested, shelled, and packed for transport with a minimum of infrastructure and can provide good returns despite a somewhat lengthy waiting time before trees are productive. In addition, many other value-added products can be derived from the raw

material. Macadamia production is still developing in the Chapare and private-sector interest in nut processing is increasing.

Tea and coffee are being produced and achieving quality acceptable to international buyers. Primary processing is done in the production area and the resulting product is readily transported and offers good possibilities for export income. The small quantity of local production remains in all cases the biggest deterrent to international traders who generally require quantities much in excess of the local production capability. Table 5-1 identifies some specific possibilities for value-added processing in Bolivia and many of these crops are also produced in Peru and Colombia.

Table 5-1—Andean Tropical Fruits and **Nuts With Market Potential**

Fruit	Processed form
Banana	Pulped for industry; dried for snack food; processed for stock food.
Papaya	Processed for pectin extract; dried.
Passion fruit (Maracuya)	Juice concentrate (frozen or aseptically packed); pulp (full-strength or concentrate; with or without seeds.
Pineapple	Canned as slices, dices, pulp or puree; juice concentrate (frozen or aseptically packed).
Nut	**Processed form**
Castana (Brazils)	Shelled, whole and pieces; confectionery (chocolate-coated); ground as marzipan.
Macadamia Nuts	In shell; shelled, whole and pieces; confectionery (chocolate-coated).

SOURCE: B. McD. Stevenson, "Post-Harvest Technologies to improve Agricultural Profitability," contractor report prepared for the Office of Technology Assessment, May 1992.

INVESTMENT IN AGROINDUSTRY

Investment in processing and storage facilities is a key need to promote alternative development in the Andean region. Although international donors have provided assistance in plant development (table 5-2), the private sector is reluctant to invest similarly. Nevertheless, there are examples of successful private sector investment, including the fruit-juice extraction plant in Cochabamba and rehabilitation of the Montero canning plant, which has expanded to process pineapples and palm hearts from the Chapare and Santa Cruz regions. In these cases, investors identified sufficient production of raw material to provide abase from which processing could expand. The citrus-juice processing plant may have a beneficial impact in import substitution and the pineapple canning operation may have export potential if costs can be contained to competitive levels.

The United Nations program has several agro-industrial plants now entering production and is providing infrastructure complementary to production increases. However, several of these plants are encountering problems in terms of their production economics, largely a reflection of the scale of plants built as pilot operations. For example, essential oils plants now entering operation in the Chapare highlight the problems. The lemon-grass oil and mint oil projects are small-scale, and have a design capacity to process raw material from 120 and 75 hectares, respectively. Processing costs are high and production is unlikely to service capital and operating costs. Additional effort is needed to assist the small industries and organize growers to support the activity.

Credit for investment in agriculture typically has been deficient in the Andean countries. Largely a result of unfavorable credit terms and eligibility requirements, this situation has contributed to sluggish adoption of alternative agricultural livelihoods. For example, in Bolivia loans are being made to small producers at commercial terms. One concern is that loans are pegged to the value of the U.S. dollar, and also are at a commercial interest rate-currently 13 percent per annum. The combined inflation rate of perhaps 15 percent and the interest rate produce a real interest rate approaching 30 percent per

Table 5-2-Value-Added Processing Investment in the Chapare Region

Industry	Source of finance	Dollar value capital	Comment
Coffee pre-processing.	AID Project 412	$ 73,835	Started in 1980; Project 412 in 1990.
Latex pre-processing	INC - AID	$ 32,900	Started in 1970; Project 412 in 1990.
Tea processing	China -1984 AID Project 412	$ 108,000 $ 166,728	In production.
Glucose plant	Universidad Mayor de San Simon/UNDCP	$ 307,174	Installation now underway.
Vinegar plant	Universidad Mayor de San Simon/UNDCP	$ 175,298	Installation now underway.
Yuca and banana drying.	AID Project 412	$ 73,897	Not yet in operation.
Banana and kudzu drying	Universidad Mayor de San Simon	$ 105,572	Starting production.
Mint oil extraction	AID Project 412		Starting production.
Lemon balm plant	AID Project 412	$ 103,200	Working; low oil return per hectare.
Milk plant	P.L. 480 United Nations	$3,200,000	Project incorporates health aspects.

KEY: UNDCP-United Nations International Drug Control Programme.
P.L. 480-Public Law 480, the Agricultural Trade Development and Assistance Act of 1954, as amended.

SOURCE: B. McD. Stevenson, "Post-Harvest Technologies to Improve Agricultural Profitability," contractor report prepared for the Office of Technology Assessment, May 1992.

annum. This is not sustainable on many agricultural programs. The loan situation is further complicated by significant failure rates, in part due to some borrowers withholding payments in the expectation that they may be forgiven the loans, the seasonal nature of cash flow, and the difficulty in achieving product sales at profitable levels. The lack of profitability, in turn, is a function of product quality and lack of infrastructure to reach major markets (28).

Any product-processing will require training local people to assume responsibility for the technical standards of the processing phase. This can be done either through training gained in a second country already experienced in the particular process, or through technology transfer and training in the host country. Both systems have merit, but the failure most commonly seen in sending people for second country training and experience is that the training is of a general nature and is too brief for technical competence to be achieved. Often the trainee returns and is diverted to an unrelated activity, or denied the resources necessary to implement new technology.

Building national capacity to take full and ongoing responsibility for implementation of new production systems is a primary goal of development efforts. The economics of bringing a single expert from overseas to teach groups of local people are obvious in terms of the multiplier effect achieved. Training programs could emphasize the use of overseas expertise within the developing country, rather than the general tour approach which frequently is seen as an excursion rather than a learning exercise. It is also important that invited expertise is of a technical level sufficient to achieve the desired level of competence in trainees. Frequently, the needed expertise is at a field practitioner level and not at the level of the professional consultant. Preparation of instruction manuals in the language of the recipient country is fundamental, and should form apart of the brief of any overseas expert engaged.

PRODUCT QUANTITY TO SUPPORT PROCESSING OPPORTUNITIES AND MARKET PENETRATION

There is a lack of product quantity to maintain some processing equipment at even pilot levels. Defining local production costs requires close liaison with the extension arm of the local development organization. This can be achieved through careful analysis of "real costs" incurred in the field which frequently differ greatly from the cost structure implied by an experimental or model evaluation. The theoretical cost of inputs may be much greater than the costs actually being incurred by low technology producers. Crop yields will usually reflect the reduced inputs and so the real production function must be known to make realistic crop recommendations. A responsible and adequately equipped field evaluation group should be an integral part of an extension effort, and should have input into the marketing process.

In some cases, the costs of production and processing can create a disincentive for producers to expand activities (e.g., Chapare lemon balm and mint oil plants). An example is the milk production plant nearing completion in the Chapare. Efforts are now commencing to increase the milk production capacity but may be complicated by high dairying costs in the region. Further, the zone is not a traditional milk-consuming area and lacks the infrastructure for refrigerated collection facilities and sales points. If the plant is to succeed, development in all these phases will be vital.

In areas where production units are small, contract farming could be developed whereby a processor contracts with producers to supply a certain quantity and quality product for processing. Thus, processors are assured of sufficient product quantity and quality and producers are assured of a market. However, a highly sophisticated level of agronomic research is required to support contract farming. Technology packages are needed that can assure a certain product quality from set production practices—information not currently available for most of the alternative crops being promoted in the Andean region.

Emphasis on product quantity and expanding production areas will be needed to reach volumes that will allow greater market penetration. Meanwhile, the short-term need is for buyers to accept small product lines with a view to developing a relationship with Andean exporters. Tariff incentives within major consumer nations and the formation of commercial links with developing countries would complement the donor government investment in regional development.

Producer Organizations

Producer organizations offer an opportunity to organize and mobilize capital and people in developing communities where conventional corporations are unable or unwilling to invest because of inadequate return, high risk, or lack of capital. These organizations provide an avenue for bulk purchase of supplies (e.g., seeds, agrichemicals, equipment); processing and marketing of products; financing; and even in some cases research and development of new crops or farming practices.

KEVIN HEALY, INTERAMERICAN FOUNDATION

Adequate storage facilities are critical in supporting production and marketing of alternative crops. Here, cocoa is being stored in the El Ceibo cooperative storage facility in the Alto Beni, Bolivia.

Producers organized into cohesive common interest groups could pool individual production to meet market product quantity requirements. The present marketing system relies heavily on intermediaries who buy products directly from individual farmers at the farm gate. Development of producer organizations could offer opportunities for smallholders to increase their bargaining power and disseminate market information (box 5-G).

In some instances, producer organizations may collectively purchase and work land, either by subdividing the land or sharing in the production of the entire tract. The more highly organized food producer organizations provide fully integrated programs for their members. Vertical integration also can offer expanded benefits by linking production, processing, and marketing. Although some efforts have been made to accomplish this in Bolivia, local politics have intervened to limit the efficiency and overburden organizations with administrative costs. Retaining an independent manager could help to avoid these problems. Involvement by the financing institution to assure internal factions do not adversely affect overall operations could be continued until the unit has attained economic independence and has demonstrated viability.

A major advantage of producer organizations is the built-in incentive for members to use services offered, increasing organization revenue. However, members generally lack incentive to purchase more than one share, limiting organization capital. There also is a danger of shortsighted decisions by members with diverse interests or limited knowledge of market economies. Some argue that not enough profit motivation exists in a producer organization to assure sufficient earnings for future growth. Nonetheless, the organization structure and similar constructs seem, in some cases, to be encouraging successful agricultural production and marketing in some areas of the Andean region.

Alternative Trade Organizations

Alternative trade organizations (ATOS) seek to establish an equitable system of trade between developed and less developed countries (LDCS). Their mission is to trade with small-scale, democratically organized LDC producers and help them obtain higher prices and increased control over the market (9).

The ATOS of the 1990s emerged out of three different trends in marketing strategies: 1) church related, 2) development focused, and 3) politically motivated. The groups with a religious base were formed primarily in the United States, while the development and politically focused organizations are rooted in Europe. Today, ATOS are most developed in Europe where they have significant government and union support. Sales of the international ATO movement totaled approximately $75 million in 1987, $8 million of which came from sales in the United States (4).

ATOS focus on returning control and profit to the peasant producers. However, they have tended to remain in marginal markets where, although they may influence conventional business, they are unlikely to pose a great threat (9). Yet, ATOS and their products are finding greater acceptance in the national and international marketplace. As "green consumerism" has flourished and the awareness of global interdependence has increased, ATOS have created a niche for themselves in the world economy (box 5-H). Thus, ATOS may have a unique and potentially important role to play in marketing Andean alternative crops or products.

Transportation

Profitable agricultural production in part depends on access to affordable necessary inputs and markets. A general lack of transportation

[4]The information for this section was drawn largely from J. DeVincenti, "Infrastructural Needs to Support Agricultural Alternatives to Coca in Bolivia," contractor report for the Office of Technology Assessment December 1991.

Box 5-G-Some Successful Andean Cooperatives

El Ceibo is a federation of 37 producer cooperatives of cocoa beans in the Alto Beni region of Bolivia. Representing some 900 peasant families, the organization offers its members multifaceted services that include agroprocessing, transport, marketing, agricultural extension, and diverse training programs in bookkeeping, accounting, agriculture, and rural development. The federation owns and manages its own industry, producing cocoa powder, baker's chocolate, cocoa butter, and chocolate candy. It sells these products nationally and internationally in Western Europe and Chile. In 1991, El Ceibo exported $600,000 worth of its products to alternative trade organizations and networks of health food stores for organic products.

The key to El Ceibo's success is a dynamic system of self-management that allows members to run their own business and services and acquire important rural development skills through intensive job training and experience. The participatory structure fosters abroad distribution of developmental benefits to peasant members and even non-members in the Alto Beni and high levels of motivation throughout the organization. By processing and marketing their products themselves, they are able to add value to their cocoa beans and attain the highest prices available to peasant producers. The positive economic incentives have permitted a continuous growth in member cooperatives and cocoa bean production over the past 14 years.

Asociación Central de Comunidades Productoras de Café (ACCOPCA) is an "association" of coffee farmers located in the La Paz department of Bolivia within the Yungas area. The group was originally created by the Centro de Investigación y Promoción del Campesinado, as an alternative to cooperatives, the traditional method of organizing small farmers in Bolivia. It was hoped that ACCOPCA would be more agile, representative, dynamic, and functional than a cooperative. Originally, the group reached out to *campesinos* through a radio program that provided farmers with information about local organizations and marketing power and a bulletin in the publication KUNATSA. ACCOPCA achieved legal status in 1980 and today there are 732 campesinos members who live in 23 small communities around the town of Coripata. The association offers a wide variety of services for its members in an attempt to develop a system based on self-management. They have established programs that address issues such as crop disease, pest control, crop diversification, and coffee marketing and export.

ACCOPCA is highly organized and its leadership structure is intact and essential to the successful management oft he group. The traditional cultural framework for conducting group activities is a fundamental part of ACCOPCA philosophy. ACCOPCA markets coffee through t he European Alternative Marketing Organization OS-3, which also works with El Ciebo. In 1987, ACCOPCA was recognized for the quality of its coffee at the international trade fair in West Germany and received the "Premio International de Alimentación" in 1988 in Barcelona, Spain.

SOURCE: K. Healy, "From Field to Factory: Vertical Integration in Bolivia," *Grassroots Development*, vol. 11, No. 2,1987, pp. 2-11.

infrastructure is apparent in the Andean region and may be the most limiting factor to improving agricultural production potential. Scheduled air service is available to numerous locations, but the transport hubs where bulk cargo shipments are possible are far fewer. Airport capacity ranges from modern international airports with adequate storage and handling capabilities to those less able or entirely lacking cargo services. Transport by water to distant markets can be an important export/import mechanism for the Andean region. Some extensive riverine systems in the Andean region are important cargo navigation systems. For example, Bolivian riverine systems provide for cargo transport from the Chapare to northern points and also to the Atlantic Ocean through Paraguay and Brazil. Rail transport provides another link for certain areas, but rail networks are not extensive. For example, systems in Bolivia serve the east and west of the country and are linked to other national systems but are not linked to one another. Further, they can be expensive and

Box 5-H—Profiles of Two Alternative Trade Organizations

The *Max Havelaar Foundation,* founded by two Dutch alternative trade organizations (ATOs) along with churches and several consumer organizations, is the largest alternative trade effort in the world. The Foundation's goal was to move alternative trade coffee into the mainstream by creating a trademark open to all roasters meeting certain purchasing criteria: direct purchase from democratic farmers' organizations, a minimum purchase price, a long-term contract with the farmers, and generous credit terms for the farmers. Over a dozen small and medium-sized Dutch coffee roasters joined the initiative.

The Havelaar Foundation began its effort in 1966. Within the first year the goal was to capture 2 percent of the Dutch market. As of December 1990, Havelaar reached 2.25 percent of overall coffee consumption in the Netherlands. Havelaar now is available inmost Dutch supermarkets and hasten times the market penetration than either of the founding ATOs alone.

Every year the Foundation purchases approximately 6 million pounds of coffee from peasant farmers. Its mandated purchase price is nearly 50 percent higher than the world market price. Because the Havelaar program demands direct payment to the growers' associations as well as favorable financing, the economic benefits to farmers may be two or three times those of the conventional coffee system.

Pueblo to People, a Texas based ATO is one of the largest in the United States. The non-profit organization was founded in 1979 to promote marketing outlets and economic support to democratically based grassroots organizations in Central America. The ATO returns $0.40 to $0.45 of each sales dollar to the producer, while the difference pays for the organization's operational expenses. Since the organization was founded in 1979, Pueblo to People has paid over $4 million to peasant producers in Latin America It reported that in 1990, $1.3 million was returned to its Latin American producers and projected that $1.5 million would be returned in 1991 (29).

Today, Pueblo to People works with eighty groups from seven different Latin American countries (29). Pueblo only works with groups that meet its social criteria, which are often the least profitable and economically risky producers. Furthermore, Pueblo looks to work with groups organized for social as well as economic reasons. Its influence allows peasants to learn organizational skills and democratic methods as well as earn income. Pueblo to People sells its products in a retail store located in Houston, Texas, and through a mail-order catalogue.

A major focus of ATOs is educating consumers about the culture and lifestyle of producers and returning a fair price to producers. For example, Pueblo to People achieves its education goal through its catalogue that contains a blend of information about products, producers, and the mission of the organization.

SOURCE: Dickinson, R., "Alternative Trade Organizations, Peasant Farmers and Coca," contractor report prepared for the Office of Technology Assessment, January 1992.

do not provide a modern or efficient mode of transport (23). Currently, Bolivia is investing in railway expansion in some areas (e.g., northeast of the Chapare to Trinidad).

ROAD SYSTEMS

Road access in many coca-producing areas is a function of weather conditions, thus restricting access for extension workers and producers. The lack of a comprehensive network of feeder roads and adequate road maintenance make transport costs a significant barrier to increased agricultural production and contribute to high production and market costs for Andean products. For example, fertilizer costs in remote areas are nearly twice that of the cost on the international market (34). Adverse road conditions take a heavy toll on vehicles adding further costs that are ultimately reflected in market prices (27).

The existing Peruvian and Bolivian road systems are largely the result of national government efforts in the 1950s and 1960s. These roads were constructed to promote colonization of remote areas of the country and increase production and availability of agricultural products (e.g., Belaunde Highway, Peru; and LaPaz-Santa Cruz, Bolivia). Although efforts to improve Bolivian roads have been made, the situation has not

improved appreciably. For example, while the network of Bolivian roads has increased by at least 100 percent in the last 20 years, only 3.7 percent of the network is paved, 22.6 percent is gravel, and nearly 74 percent is dirt (22). Poor drainage conditions of the dirt roads continue to cause transport interruptions in rainy seasons. The current condition of Bolivian and Peruvian road systems is poor and, for a variety of environmental and security reasons, little ability exists to maintain or improve conditions.

Colombia placed considerable effort on developing its transportation network; however, transport costs remain high reflecting the difficult nature of the country, lack of modern transfer and transport facilities, and the generally low efficiency of operators. Infrastructure for farm-to-market access and intraregional connections received lower priority than interregional connections and today remain the weak link in the domestic transport system. Rural road construction and improvement and maintenance of the existing national highway network have been started recently to address this situation (38).

The virtual absence of refrigerated transport vehicles in the Chapare region is a primary constraint to improving marketing of agricultural products. Of the handful of refrigerated trucks in the Chapare, perhaps three are dedicated to the fresh produce business. Little incentive exists for private investment in such transport due to the unreliability of specialized vehicles, high maintenance costs, and low returns in the fresh product market. The Bolivian bananas arriving by road to Arica in Chile must compete with the sophisticated Ecuadorean production and transport systems, which achieve a quality product at a lower price.

Loading and transportation time in addition to difficult road conditions further affect marketing potential. At a minimum, the trip from Chimore in the Chapare, to Arica in northern Chile is a total of 700 kilometers, taking 3-1/2 days of constant driving. Although much further, the trip to the major Argentinean market of Buenos Aires benefits from excellent roads across the frontier. However, it is still 4 days minimum and involves transfer of the cargo at the border.

Despite these difficulties, small shipments have been made to both destinations and products sold in both markets. In order to assure buyers of a specific quantity and quality of desired produce it will be necessary to address infrastructure problems. For example, although Bolivian exports to northern Chile and Argentina have been described as success stories, recurring problems with product quality have created consumer resistance to the Bolivian product. These problems arose from lack of a well-established cold chain and transport infrastructure in advance of opening new markets and further highlight the danger of entering a new market before the basic export infrastructure is in place. To date, buyers have shown perseverance in helping Bolivian products become established in their markets, although it is questionable how much longer buyers will assume abnormal losses as a normal business hazard (28).

STORAGE, PACKING, HANDLING FACILITIES

Storage infrastructure from production point to market is insufficient. This situation contributes to seasonal price fluctuations resulting in low producer prices during harvest season and high consumer prices in off seasons with the greatest benefits accruing to the intermediaries, There are two cold storage units now approved for construction by AID in the Chapare and the first may be operational in 1992. Similarly, grain storage capacity is limited and silo capacity is needed.

In the Chapare, nearly all local market produce is transported by open truck, without any attempt at primary processing or packing. Size and dispersal of production units in the coca-producing regions complicate efforts to design packinghouses for fresh products. At present packing technology in the Chapare region is a field operation using small, rain-protected packing sheds where fruit is washed and treated with fungicide dips to extend storage life. The availa-

KEVIN HEALY, INTERAMERICAN FOUNDATION

El Ceibo, a federation of 37 cocoa producer organizations in the Alto Beni, Bolivia produces cocoa powder, baker's chocolate, cocoa butter, and chocolate candy for national and international markets. Exports totaled U.S. $600,000 in 1991.

bility of a clean water source at the packing site is paramount to a successful operation. Despite the region's high rainfall, this need can be limiting, often requiring shallow wells adjacent to packing facilities. In addition, lack of rural electricity sources requires manual pumping to fill washing tanks. It is anticipated that electricity will be available in the next 2 years to much of the Chapare, facilitating mechanization of crop processing and handling and is a high priority for improving postharvest handling in the region.

Communications

Effective communications systems are critical to' producer decisionmaking on crop, market, processing, and transport opportunities. Currently, communication networks in coca-producing areas are inadequate. For example, in the Chapare communications are provided by Institutional radio and two or three public telephones. The system is inefficient and is a further deterrent to private-sector involvement. Establishment of communications systems in remote areas, however, is likely to be subject to the same constraints as road development. While wireless communication technologies can reduce the need for physical structures (e.g., telephone poles, underground cables), they are costly.

Information availability does not pose a key constraint in itself since many information systems exist. Moving the information to producers, however, is a primary need. Development efforts could include mechanisms to develop local information collection and dissemination for producers of legitimate crops through cooperatives or other joint activities. Subscriptions to international information services would be needed to support this activity (27). Producer organizations

Poorly developed and maintained road systems take a heavy toll on vehicles, particularly in areas with heavy rains. Little incentive exists for private investment in transport due to the unreliability of specialized vehicles and high maintenance costs.

may provide a mechanism to pool producer resources to invest in communications and disseminate information to members,

Improved communications are nececessary to assist in promoting export opportunities and coordinating complex transport interlinking. The remote nature of producing regions and producer inability to purchase or maintain communications systems are areas to be addressed to support alternative crop production. In large part these constraints could be addressed through development efforts in coordination with national governments.

Engineering activities in tropical regions frequently are difficult and some past activities have been linked to significant environmental problems making such development unpopular with the public at large as well as potential donors. Financial resources are the limiting factor in every phase of infrastructure development, followed closely by construction capability. Funding resources alone likely are insufficient to solve the problem.

Thus, the broad-based infrastructure needs for improving production and marketing of legitimate crops include: 1) road development and maintenance; 2) additional and improved vehicles; 3) processing, handling, and storage facilities; 4) reliable energy sources; and 5) information systems via communications networks. Addressing all of these needs is likely to require significant investment on the parts of national governments and donor organizations. Without such investment, however, efforts to develop alternative crops and livelihoods will continue to be disadvantaged.

AGRICULTURAL TRADE POLICIES[5]

The United States is a key trading partner with many South American countries; U.S. exports comprise nearly 43 percent of the market share in Colombia and 20 percent in Bolivia (19,11). U.S. investment in Latin American and Caribbean agribusiness has grown significantly since 1987. Primary targets have been Mexico, Brazil, and, to a lesser extent, Argentina, Venezuela, and Colombia (36). This trend is expected to continue under new trade initiatives designed to promote opportunities for U.S. producers and exporters in conjunction with increasing trade flexibility for the Andean countries.

The United States enforces a broad range of trade policies, ranging from import quotas and tariffs to complex food safety, sanitary, and phytosanitary requirements to protect domestic industries and human, plant, and animal health. While some protectionist policies have been waived temporarily,[6] meeting food safety and

[5] The information for this section was drawn largely from L. Turner, "Primer on U.S. Agricultural and Trade Policies: Opportunities and Constraints to Crop Substitution in the Andean Nations, ' contractor report for the Office of Technology Assessment, February **1992.**

[6] **The debate** over this came to a head in the late 1980s in a dispute between the U.S. Department of Agriculture and AID/Bolivia over U.S. technical support for Andean soybean producers. Domestic concerns focused on the potential for Bolivian production to adversely affect the U.S. industry. Development groups argued that the Bolivian production was unlikely to even reach 1 percent of the global soybean market.

quality requirements remains a significant challenge for potential importers. Training and technical assistance can help improve compliance with regulations and also help build local expertise to address similar problems in domestic food systems.

Trade Policy Initiatives

A number of agreements and initiatives are intended to promote extra- and intra-Andean trade. U.S. administrative initiatives include the Uruguay Round (under the General Agreement on Trade and Tariffs (GATT)), the Andean Trade Preference Act (ATPA), and the recently proposed Enterprise for the Americas Initiative (EAI) (box 5-I). The result of these actions on Andean economies is not yet clear.

Agriculture emerged as the most contentious issue in the Uruguay Round of GATT negotiations. Developing nations abandoned negotiations contending that an agricultural commitment was essential to their continued participation in GATT. Efforts to increase trade of Andean products will need to examine potential trade strategies with respect to GATT rules to avoid challenge and possible retaliatory action from other GATT nations.

Emphasis on trade assistance for the Andean countries has included several commitments: to expedite Generalized System of Preferences (GSP) review under GATT, to provide technical assistance for the agricultural sector, to explore opportunities for expanded textile trade, and to reestablish an International Coffee Agreement (ICA). Although some of these areas have been pursued, restoration of ICA remains elusive although it is considered critical in the Andean region. International trade in coffee largely has been controlled by export quotas established under the ICA. The latest ICA collapsed after contentious debate leading to a sharp reduction in world coffee prices. Coffee exports, nevertheless, are substantial for Colombia, and comprise part of Bolivian, Peruvian, and Ecuadorian income. Colombian coffee exports accounted for 51 percent of the country's 1985 legal export earnings, 7 percent for Ecuador, 5 percent for Peru, and 1 percent for Bolivia (34). Current interest in negotiating an ICA likely will focus on modifying quotas to reflect demand for different varieties of coffees and prohibitions on sales to nonmember nations.

Trade Preference Programs

Providing preferential trade arrangements with developing countries is one approach to stimulate their economic growth and has been included in GATT in a variety of forms. This approach is reflected in U.S. trade policy in the GSP, the Caribbean Basin Initiative (CBI), and most recently the Andean Trade Initiative (ATI). The latter two are specialized forms of the GSP and reflect U.S. efforts to provide greater trade advantages to specific beneficiary countries (table 5-3).

The GSP program promotes economic development by opening trade opportunities for lesser developed countries by offering zero-or reduced-duty on certain imports. The Andean nations are beneficiary nations individually, and as part of the Andean Group-an association allowed to be treated as a single country for purposes of GSP eligibility. Products that exceed a certain level of competitiveness may be removed from the U.S. GSP program, although the President may waive these limitations. Similarly, countries may be removed from the GSP program as level of development increases, market penetration increases, or as a sanction protesting other practices of the participating country (e.g., trade practices, worker rights violations).

The GSP program covers raw and processed products; however, value-added products must comply with the rules of origin.[7] If the raw material originates from a non-GSP country, the

[7] At least **35 percent of the cost or value of the article must be attributable to direct** costs of processing in the beneficiary country.

Box 5-I—Selected Trade Policies Affecting Andean Trade

A number of trade agreements, economic policy reforms, and legislation affect Andean trade. Many have occurred in t he past several years and how they will affect national economies is not yet dear. The following briefly summarizes some initiatives likely to play a role in the international trade activities of the Andean region.

Andean Pact

The Pact wasa result of a trade framework established in the 1969 Cartagena Agreement. Members include Venezuela, Colombia, Bolivia, Peru, and Ecuador. The goal was to harmonize member trade and investment regimes through preferential tariff structure for member countries, develop a common external tariff, and develop agreements on investment and intellectual property rights. Recent activities under the Pact include:

- . Subsidy program elimination for intra-Andean trade and agreement to create a common Andean market by 1996,
- . Establishment of free trade between Venezuela, Colombia, and Bolivia in January 1992 with expected additions of Peru and Ecuador in July 1992,
- . Tentative agreement on common external tariffs for most goods, although the treatment of the agricultural sector remains unclear,
- . Initiation of national treatment of foreign investors, and
- ● Establishment of minimum standards on patent and trademark protection, allowing individual members to implement stricter laws (19,20).

Andean Trade Initiative

Authorized through the Andean Trade Preference Act of 1991, the Andean Trade Initiative (ATI) establishes preferential trade arrangements for Bolivia, Colombia, Peru, and Ecuador with the United States. ATI provides duty-free access for certain Andean exports for a 10-year period pending country-specific determination by the President. Products excluded from duty-fee status include textiles, footwear, canned tuna, petroleum, rum, and leather goods. As a result of the ATI a number of Andean exports are expected to increase as well as Andean demand for U.S. goods and services to support economic expansion (6). Trade has yet to be visibly affected by the ATI, making projections difficult.

Enterprise for the Americas

This initiative offers market access, financial and technical resources, and debt reduction to countries that liberalize trade and investment regimes, maintain sound economic policies that promote investment and competition, and responsibly manage international debt obligations. The intent is to stimulate economic growth in the entire Western Hemisphere through increased trade and investment and reduction of official debt. Key components include:

- . Trade-hemispheric free trade, an incremental approach beginning with smaller free-trade associations such as the North American Free Trade Agreement (among the U. S., Canada, and Mexico) and the Andean Pact;
- . *Investment*—stimulate investment reform and privatizationthrough the Inter-American Development Bank programs, Investment Sector Loan Program (ISLP), and Multilateral Investment Fund (MIF); and
- . *Debt*—reducing debt obligation to the United States through a variety of mechanisms including congressional reduction of food aid debt and debt-for-nature swaps (26).

Some benefits associated with this initiative have been visible in Bolivia:

- . Development of a bilateral framework agreement establishing the U.S.-Bolivia Trade and Investment Council,
- ● Elimination of $371 million in debt to the United States, and
- . Grant of an Investment Sector Loan in 1991 (11).

SOURCE: Office of Technology Assessment, 1993.

Table 5-3—Exports Expected to Increase Under t he Andean Trade Initiative

Country	Product
Bolivia	Cereals (including rice), cut flowers, wood products, and spices.
Colombia	Cut flowers (particularly roses and chrysanthemums), fresh tuna and skipjack, glazed ceramic products, raspberries, grapes, tropical fruits, and melons.
Peru	Rope, zinc, copper wire, lead, precious metals, asparagus, seafood (including yellowtail, mackerel, and sardines), tomatoes, and dried potatoes.
Ecuador	Cut flowers, fresh tuna and skipjack, pineapple and grape juice, iron and steel wire, limes, tropical fruits, and melons.

SOURCE: E. Turner, "Primer on **U.S. Agricultural Trade Policies: Opportunities and Constraints to Crop Substitution in the Andean Nations," contractor report prepared for the Office of Technology Assessment, February 1992.**

final product must be 'substantially transformed' in the beneficiary country. Changes in product and country coverage are made through general and annual reviews, and any interested party may petition for such a change.

Tariff and Quota Policies

A variety of restrictions control imports to levels that will not adversely affect U.S. producers. Largely, these controls take the form of tariffs and quotas on specific commodities, Tariffs are the preferred means for restricting imports under GATT. Although member countries have been encouraged to maintain tariffs at existing levels, or not to increase them beyond a specified level, such a proposal has not been agreed upon.

Tariffs imposed by the United States and other major importing nations tend to escalate as products move through the processing chain. This approach is suggested to have inhibited growth of processing industries in some developing countries (5). Review and possible revision of tariff schedules for processed Andean products could complement crop substitution efforts and contribute to growth of the value-added industries.

Import restrictions may be placed on certain products that may undermine any USDA domestic commodity program (1).[8] These section 22 fees and quotas are designed to keep product prices above the government price support level and to protect U.S. producers by stabilizing domestic prices, particularly during times when world prices are low. Such import restrictions apply to all nations, irrespective of other trading arrangements with the United States (e.g., CBI, ATI).

The Sugar Tariff Rate Quota system is designed to protect the domestic price-support program for sugarcane and sugar beets. Sugar imports are restricted by a country-by-country tariff rate quota system in effect since late 1990.[9] Imports up to the quota amount are subject to a small duty and levels above that are dutiable at a significantly higher rate. This system helps support a U.S. market stabilization price much higher than the world price (21.5 cents vs. 9.2 cents) (17). Bolivia recently requested an expansion of its sugar quota from 16,000 to 100,000 metric tons to help provide alternatives for some farm laborers involved in coca production (10). The request was denied, however, and critics suggested the benefits would accrue to plantation owners and processors rather than the target population (24).

Tariffs are also imposed on sugar-derived products such as alcohol fuels. A schedule of

[8] An investigation on the effect of imports on U.S. commodity programs is conducted by the U.S. International Trade Commission however, ITC's report is merely advisory and the President may set fees or quotas irrespective of its content.

9 Revised based on a GATT ruling that the 1981 absolute quota system was not in conformity with GATT rules. Yet, the effect Of the new program, in terms of restricting sugar imports, was identical to the old quota program.

tariffs was developed to curb imports of alcohol fuels in 1980 and protect U.S. corn and ethanol producers, although ethanol auto fuels remain a small part of the overall gasoline pool (i.e., less than 1 percent). Tariffs for ethanol imports currently run $0.54 cents per gallon (21), Proponents of ethanol fuel suggest the market will expand in response to environmental concern over fossil fuel use and carbon dioxide reduction policies. While ethanol largely is produced from sugarcane and corn, many plants may be used as feedstocks. Technology exists to use a variety of grasses in an ammonium freeze explosion process to produce ethanol. Tariff reductions for ethanol could provide incentive for industry development in the Andean nations. In addition to U.S. imports, several South American countries are large users of ethanol auto fuels (e.g., Argentina, Brazil).

Countervailing duty and anti-dumping laws seek to preclude unfair competitive advantage importing countries might have over U.S. producers as a result of foreign subsidies or by marketing products at less than their fair market value. Imports suspected of violating these conditions are investigated by the U.S. Department of Commerce and International Trade Comrnission.[10] Additional duties may be imposed on products determined to violate these laws. Subsidies and other assistance promoting agricultural development in the Andean nations potentially could be challenged under U.S. countervailing and anti-dumping laws (15).

Food Safety and Quality Requirements

Imports to the United States are subject to quality and grade standards and requirements deemed necessary to protect human, animal, and plant health. The USDA's Animal and Plant Health Inspection Service (APHIS) and Agricultural Marketing Service (AMS) are responsible for phytosanitary and produce quality programs, respectively. The U.S. Department of Health and Human Services' Food and Drug Administration (FDA), the USDA Food Safety Inspection Service (FSIS), and the U.S. Environmental Protection Agency (EPA) are responsible for regulating health and safety programs. Phytosanitary regulations can pose unique challenges for developing countries. They can restrict trade if applied in an arbitrary manner or if compliance assistance is difficult to obtain. Provision of technical assistance and training could offer benefits for industry development domestically and internationally.

PHYTOSANITARY REQUIREMENTS

Plant, live animal, and meat product imports are subject to APHIS inspection and quarantine requirements, Inspections may be conducted at port-of-entry or in producing countries. APHIS personnel are authorized to enter cooperative programs with counterparts in foreign countries to control or eradicate pest problems. Such programs may minimize potential infestations in the United States as well as provide valuable training for importing countries that can contribute to improvements in national food systems (2, 3). Currently, APHIS personnel are stationed in Peru and Colombia to assist in complying with U.S. phytosanitary requirements; this may expand as a result of Andean Trade Preference Act.

SANITARY AND FOOD SAFETY REGULATIONS

Imported goods (except meat and poultry products) are subject to FDA inspection for compliance with health, safety, packaging, and labeling requirements. Food products that are unsafe, produced under unsanitary conditions, or that contain illegal additives or pesticide residues are prohibited from entry. Imports are subject to inspection and testing at time of entry, although it is estimated that *no* more than 1 percent of FDA-regulated food imports are actually tested.

10 U.S. Department of Commerce investigations examine whether or not subsidies are being supplied *directly* or indirectly, or if the product is being sold in the United States at less than fair value. The International Trade Commission investigations focus on the potential injury to U.S. producers,

Inspection programs have been criticized for failing to provide adequate protection.

All domestic and importing commercial processors of heat-processed, low-acid canned foods and acidified foods and shellfish are required to register and file processing information with FDA. Requirements for sanitary food production facilities are explained in the FDA's Current Good Manufacturing Practice Regulations (available only in English). While the FDA does not have authority to conduct foreign plant inspections, personnel may travel to help solve public health threats at the request of foreign governments.

Food importers must have access to current U.S. food and safety labeling regulations to export effectively. Further, facilities to monitor compliance with import regulations could assist in improving the domestic food system and international marketing of food products. If food processing is to take a greater role in providing alternative livelihoods in the Andean countries, assistance in the form of compliance training is a key need.

MEAT AND POULTRY INSPECTION

FSIS is responsible for assuring the safety, quality, and accurate labeling of meat and poultry products. Importing countries inspection systems must be equivalent to the U.S. system and be evaluated and approved by FSIS. Currently, no South American countries are authorized to ship meat and poultry products to the United States (33). Development of meat or poultry product industries for export to the United States will require development of Andean inspection facilities, technical assistance, and training.

MARKETING ORDER REGULATIONS

AMS is responsible for regulating produce quality standards. Inspections are conducted only at point-of-entry and costs for this service are charged to importers. There are 15 marketing orders that regulate minimum grade, size, and quality requirements for imports. Although marketing orders apply only to quality of imports, meeting these requirements may also pose challenges for poorly developed export systems. Available infrastructure, handling, and shipping technologies in the Andean nations currently are inadequate to handle increased export opportunities.

Trade incentives form a principal thrust of the U.S. strategy for promoting agricultural production in the Andean countries. Recent trade initiatives indicate a U.S. commitment to improving the ability of these countries to compete in the international marketplace, Yet, the value of these trade concessions may be overshadowed by future agreements with other countries (e.g., North American Free Trade Agreement). Nevertheless, complementary efforts are needed to assist the Andean countries to comply with the numerous phytosanitary, sanitary, safety, and quality requirements for imports.

It may be useful to evaluate trade incentives with respect to their contributions to the overall Andean economy. This could include promoting development of related economic sectors rather than the narrow agricultural focus of current substitution efforts. It may also be useful to evaluate the impact of trade incentives in terms of the global trade environment, recognizing that development of trade agreements with other nations could adversely affect U.S. demand for certain Andean products.

The need for restrictions on agricultural assistance activities should be re-evaluated in relation to the actual 'threat' to U.S. agricultural production. Previous reports suggest the potential effect of certain increased Andean agricultural imports on U.S. producers was negligible. Further, in light of the emphasis on trade liberalization and reducing subsidies and barriers to trade, these may become key issues in future GATT negotiations.

STRATEGIES TO SUPPORT RENEWABLE RESOURCE-BASED ALTERNATIVES TO COCA

> One way of summing up is to insist that advising "shock treatment" for countries with weak or missing market institutions or limited technical capacity—that they go "cold turkey on policy reform-must be rejected as little more than self-indulgent intellectual sloth, It reflects a lack of willingness to invest the intellectual energy necessary to understanding the economies and the societies for which reform prescriptions are being written (25).

Strategies to enhance coca substitution efforts must address a wide variety of constraints from production to marketing. Producers are unlikely to cease coca production in favor of alternative crops or activities if they cannot be assured that a market exists and that the mechanisms are in place for production, harvest, processing, and transport. A shift from a production- to market-driven approach is evident currently in Cochabamba Regional Development Project. Nevertheless, the support structure necessary to sustain alternative livelihoods is lacking or inadequate.

Recent U.S. policies have been designed to increase comparative advantage for certain Andean products (e.g., ATI) in U.S. markets. Revision of credit programs could improve the opportunities for smallholders to obtain financing for entering legitimate production systems. Credit revisions could mimic current U.S. subsidy programs, providing loans to farmers at lower rates than presently exist in the Andean countries. Such an effort with planned obsolescence as a goal, could be relatively short-term, provide appropriate grace periods prior to repayment (i.e., allow for real production to occur), and perhaps augment or replace eradication payments as a method of inducing change. Further, supporting national governments in encouraging greater domestic food production could increase the viability of Andean agriculture. Such an effort could incorporate financial incentives and loan programs, and improved export and import policies.

Strategies to improve support for alternatives to coca in the Andean region will likely require attention to:

- National research and extension systems,
- Opportunities for value-added processing and increased product competiveness,
- Infrastructure to exploit and export the product, and
- Increased trade opportunities (31)

Strategy: Support National Research and Extension Systems

Enhancing agricultural profitability in the Andean nations will require continuing and significant investment in research and extension to develop alternatives and demonstrate techniques and technologies to potential adopters. However, national funding for research and extension activities may be difficult to secure and U.S. international academic research and extension activities are declining.

While research and extension activities were large components of early AID crop substitution efforts in Bolivia, the level of effort has dropped. Continued devotion of funding and effort to long-term research and extension activities is hampered by pressure to produce immediate results. Research on developing alternatives and demonstration and extension of this information to potential adopters are long-term propositions—conservatively running 10 to 15 years while standard project lengths are only 5 years (31).

To overcome this situation, emphasis could be placed on local and national research centers to promote institution building and skill development, thereby improving the potential for activities to continue after direct assistance is withdrawn. Agronomic management research could be oriented to on-farm, farmer participation production trials, involving the local farm population in direct participatory research. Extension activities could emphasize on-farm demonstra-

tion and farming systems to maximize the diffusion of new technologies and practices to rural adopting populations. On-farm trials should be maintained for sufficient time to demonstrate effectiveness and promote technology/practice diffusion (7,27,31).

Strategy: Improve Opportunities for Value-Added Processing

Increased agricultural productivity is likely to do little for producers' economic well-being if producers cannot effectively and efficiently apply improved postharvest technologies. Such applications will be necessary for alternative crops to become significant in terms of total agricultural exports. Current formal exports of some alternative crops (e.g., turmeric, ginger) are at no more than trial levels. Success will be dependent on the establishment of cost-effective, postharvest processing, as well as the enhancement of producer efficiency through reduced production costs and increased yields (27,31).

For the Andean countries to increase their agricultural export earnings and reduce agricultural imports, major public and private-sector investment will be necessary. AID is a major contributor to Andean country development of legitimate economies. The channeling of that contribution is a joint effort between the offices of the recipient government and the AID coordinating office in the benefiting country. The effectiveness of the AID investment can be enhanced in a number of ways:

Implement Training Programs-Emphasis could be placed on specific technical training at the production technique and processing level, involving the import of short-term expert assistance with a group training responsibility. Programs with specific training objectives, directed to practical-level personnel who can be integrated into production or processing units such as they are expected to manage in their home country, could recieve priority. The need for language training as part of a training proposal should be reviewed and adjusted to promote participation in educational exchanges. Professional training cannot be neglected, but this too must be monitored carefully to ensure trained people remain in positions justifyng their preparation and benefiting the AID program (27).

Prioritize AID Investment—Where investigation results have demonstrated agronomic potential of a crop, the processing and marketing infrastructure should be developed along with the expansion of production, so that market outlets for production will be in place when production goals are realized (27).

Promote Producer Organizations—The development of strong producer organizations that can aggregate products for sale to processors, intermediaries, or consumers could overcome the problem small individual producers have in negotiating just prices for their product (27). A grassroots development strategy may be the most appropriate mechanism for assisting rural communities in processing, storage, marketing, and transport of a diversity of agricultural commodities. Grassroots organizations typically have strong support from local populations and understand local cultures, aspirations, and priorities. Abundant organizational skills exist within Bolivian grassroots organizations, *sindicatos.* These groups have a long tradition of solving development problems and promoting rural reform in the Chapare and elsewhere in Bolivia. Bolivian crop substitution programs might work cooperatively with *sindicatos* to promote peaceful crop substitution and alternative development efforts (31). (See chapter 2.)

Promote Private Investment in Processing— Loans to the private sector at realistic interest rates could promote entrepreneurial activity, and ultimately replace the need for AID and other contributing institutions to maintain the present high level of investment in infrastructure and agroindustry. Careful investment evaluations should be conducted, and full market histories and the long-term strategy should be a part of the Project Evaluation (27).

Strategy: Promote Infrastructure Development

Infrastructure is inadequate to support alternative development (e.g., paved roads, bulking and storage facilities, agroprocessing plants). The high cost associated with infrastructure development in remote areas is prohibitive in terms of normal financial assistance. Economic studies must explore fully the infrastructure and integrated development of alternatives, and environmental impacts should be identified and mechanisms to mitigate them included in project design and planning (27).

Infrastructure development is approached slowly, however, because of the potential benefits that might accrue to coca transporters (e.g., road developments are seen as potential landing strips for narcotics traffickers). Although infrastructure development might initially contribute to the coca economy, alternative development and production cannot occur without adequate transportation and marketing routes. Interdiction, monitoring, and enforcement of illegal activities also could be simplified with improved transportation networks (8).

Investment in transportation infrastructure, accompanied by expanded credit programs in production systems can help coca-dominated economies move to more profitable, exportable alternatives (8,27,31). Long-term involvement with this development, and greater emphasis on expanding legal production rather than eliminating coca, could ultimately achieve coca reduction goals. Resources must be channeled in an ordered, well-planned basis with the knowledge that the political requirements for short-term, demonstrable achievements will precede the overall success of the program (27).

Strategy: Increase Trade Opportunities for Andean Products

An increased share in the international market can contribute to improving the economies of the Andean countries. Current crop substitution approaches have focused on this approach, largely through promoting production of high-value crops, to generate foreign exchange for national governments. However, meeting complex food safety, sanitary, and phytosanitary requirements is often difficult for developing nations. There are some avenues for assistance in developing capacity for meeting these standards. Additionally, developing national abilities to ensure quality and safety standards for produce could help in meeting U.S. import requirements as well as those of other countries. Compliance with these standards could contribute to increased competitiveness of Andean products in international markets and could yield additional benefits by increasing the range of trading partners, encouraging foreign investment, and improving national food systems (27,30,31).

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Locally produced bananas are being prepared for transport. However, these producers are at a disadvantage compared with other highly sophisticated production and marketing systems.

Improve Ability to Meet Quality and Safety Standards for International Markets—Increased exchange among U.S. agencies and potential Andean exporters could assist in identifying key needs to facilitate trade. Such exchange would allow greater insight into the difficulties faced by foreign producers/exporters and familiarize them with U.S. requirements for importing products.

Again, technical assistance will be a critical component (27,30).

Reduce Import Tariffs for Andean Products to Complement Crop Substitution Programs—Although the ATI and certain waivers have reduced import barriers for some Andean products, this effort could be expanded to provide reduced tariffs for all products linked to alternative development projects. While this may run counter to some U.S. commodity support regulations, import levels would likely be low, creating little competition with U.S. producers. Further, the program could contain a clearly identified time frame after which review and possible revision could be undertaken (30,31).

Provide Incentives for Value-Added Processing—Typically, tariffs increase as products move through the processing chain, i.e., raw materials generally are subject to lower tariffs while processed items have higher tariffs. This aspect of U.S. trade policy has been suggested to reduce incentive for development of value-added industry in exporting nations. U.S. tariff policies on value-added products could be reviewed and modified if they are determined to affect development of processing industries in the Andean region adversely (27,30).

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