

PD-ARD-453
75684



600 Water Street, S.W., NBU 7-7
Washington, D.C. 20024

telephone: (202) 484-7170
telex: 4990821MANSY

fax: (202) 488-0754

**WORK PLAN TO ESTABLISH AN
INTEGRATED MANAGEMENT INFORMATION SYSTEM
FOR THE COCHABAMBA REGIONAL DEVELOPMENT PROJECT
IN BOLIVIA**

prepared by

**Donovan P. Rudisuhle
Management Consultant
P.O. Box 1633
Laramie, Wyoming 82070**

for

**Management Systems International
Washington, D.C.**

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EXECUTIVE SUMMARY

- 1. The Cochabamba Regional Development Project has requirements for a useful management information system that satisfies multiple needs. This includes those of local management, funding organizations and outside third parties concerned with alternative development. While implementing such a system will require a considerable amount of effort, there are not any insurmountable obstacles that would prevent it from becoming a reality.**
- 2. Organizations working under the predecessor project, the Chapare Regional Development Project, have developed a number of systems on their own initiative. The lack of guidance and coordination has resulted in these systems being incomplete and incompatible with each other. Data is often trapped at lower levels and sometimes does not arrive to the end users who could benefit from it. There is no systematic collection and analysis effort across all organizations participating in alternative development, which has resulted in a lack of coordination between their efforts in the field. Additionally, because data does not reach certain organizations responsible for consolidating and disseminating information, USAID has not received proper recognition in the local media for its efforts in economic development in Bolivia.**
- 3. The cornerstone of the proposal for field level data collection system is the proposal advanced by the agricultural extension advisor, whereby the extension function will be restructured around the *centrales* and *sindicatos*, the community organizations which represent most farmers in the Chapare. This concept offers the best prospects for obtaining timely, accurate data regarding acreage under cultivation, production levels and sale of agricultural products. According to field personnel, considerable data on crops has already been compiled by these organizations, but has never been collected systematically by the project.**
- 4. Some systems will have to be designed from scratch. In the case of exporting, which is a relatively new phenomena, determining the best system to measure it will be a trial-and-error exercise. Other systems for areas that are well-established, such as infrastructure building, will be easier to upgrade and integrate.**
- 5. All organizations consulted were enthusiastic about participating in the efforts to create an integrated management information system for the new project. Proper management, coordination and follow-up will be critical in making the effort become a success. The concept of creating a position for**

an "Information Czar", for USAID's Cochabamba Office has been suggested. This person would be responsible for overseeing all aspects of the implementation of the new system as well as its subsequent operation.

6. The systems that have evolved spontaneously over the last five years have used a variety of platforms and environments. Before any serious design work can evolve into software, it will be essential to create a standard, comprehensive set of specifications for the entire system. This involves describing in detail the information that will be collected and the databases that will contain it. Based on the requirements for information sharing and transmittal as well as local support, the best applications development platform for creating such a system is Informix 4GL. Some modifications of computer hardware will also be necessary.
7. Financial management and accounting are major components of the new system. Although the current software is inadequate for future needs, no serious modifications or changes in software should be performed in this area until the master set of specifications for the entire project has been completed.
8. The implementation can be done in phases, starting with the areas of highest priority: production, exports and foreign exchange. Other systems can be developed concurrently. The speed of implementation will be dependent on the amount of resources allocated to the task. Because of its diversity, the project's absorptive capacity for technical assistance is relatively high.

A. INTRODUCTION

In January 1992, the consultant spent three weeks in La Paz and Cochabamba meeting with personnel from USAID and many of the organizations involved in alternative development that receive funding from USAID. Verbal summaries of findings and conclusions were presented to officials of USAID Bolivia, IBTA Chapare and AID/LAC/SAM in Washington. A list of contacts can be found in Annex 1.

The consultancy was an evolution of work performed during June-August 1991, when the consultant performed an evaluation of the financial management function at IBTA/Chapare. In a report issued August 31, 1991, the consultant advanced the proposition that the project should consider the design and implementation of an integrated management information system that encompasses all types of data generated by the project, both technical and financial. This suggestion was motivated by the fact that the consultant discovered that various components of the project had accumulated significant amounts of data at the field level, but that it was not being utilized properly at that level or transmitted to higher levels. To the consultant, it appeared that there was considerable potential in the field to improve project management information and reporting, if only these existing sources could be tapped and refined. The issues involved in designing such a system were the focus of a major section of the consultant's report.

The consultant's 8/31/91 report contains important background information regarding the evolution of the consultant's work in the area of information systems and would also provide the reader with insights into the current approach to the problem.

The proposed information system will fill a number of needs under the new Cochabamba Regional Development Project:

- 1. Provide all of the implementing organizations within the project the data necessary to manage their day-to-day activities, particularly with respect to service delivery to farmers.**
- 2. Establish solid baseline figures and accurate periodic reports that help ensure that the project is on track towards meeting its goals. This information can be used to effect prompt corrective measures at the time problems arise, before they can get out of control.**
- 3. Permit USAID officials in La Paz to monitor the progress of the project and review implementation strategies on a periodic basis.**

4. **Facilitate the release of reliable reports regarding project achievements to organizations of the U.S. and Bolivian governments as well as to the media.**

B. INDICATORS

Project impact can be measured in a number of ways:

1. **First, infrastructure creation and upgrading is constantly under way. This is an important project accomplishment and should be measured and reported on a regular basis. The infrastructure building can be of two different types: physical and human. Each can be expressed in a variety of units: bridges built, farmers trained, roads upgraded etc.**
2. **The second major category of indicators of project headway is found in the tangible outputs that are measurable in the forms such as increased areas under cultivation and increased production sold to both the domestic and international markets.**

C. DATA COLLECTION MECHANISMS

The complex nature of the project and the wide variety and volume of data to be collected and analyzed translates into the requirement of the creation of numerous independent systems that feed into a central mechanism. These subsystems will vary significantly in that they will be created around different organizations and will collect specialized data. Also, the quality of the information will be enhanced by building a certain amount of redundancy into the system so that cross-checking between systems is possible in certain areas.

D. INTEGRITY OF THE DATA

Indisputably, good data is hard to come by in a large, complex project like the Chapare Regional Development Project. In the past, it has been necessary to occasionally revise figures submitted to AID because it was later determined that the initial field data was inaccurate. This is understandable given the distances involved and the embryonic nature of the processes that are producing the numbers. However, the project should strive towards delivering top quality data regarding its activities and achievements.

One of reasons for proposing a new integrated management information system is the need to establish a data validation mechanism that will serve to improve the

accuracy of the numbers submitted from CORDEP to USAID/La Paz. In the instances where it is possible, the first step in the validation of the numbers will be accomplished by comparing data obtained from multiple sources. In all cases, a primary source of data will be designated. Secondary sources will be tapped for additional information, even if the data flow is sporadic. The data from these various sources will be incorporated into a single report which will be presented for analysis by the information system committee.

In order to increase the integrity of the inputting function, sophisticated error-trapping routines can be incorporated into the software so that any data that is entirely unreasonable will not be accepted by the system without an override from the operator.

The documentation supporting the numbers submitted in the quarterly and semi-annual reports to Washington should be available for inspection. The documentation should always agree to the officials numbers and should stand up to audit, just like the numbers in the financial statements.

E. SYSTEM 1: AGRICULTURAL PRODUCTION IN THE CHAPARE

The hierarchy of *centrales*, *sub-centrales* and *sindicatos* provides an established network which can be used to channel data from the field into the project. These structures have been in place for a long time and can easily be adapted to manage the exchange of information. Many times in the past, these organizations have been used to elicit the participation of farmers in project-sponsored activities, such as the recent Coca Law Seminar held in September of last year where 600 persons attended from 6 *federaciones* representing 53 *centrales* and 260 *sindicatos*.

The *centrales* are said to maintain manual listings of all farmers in their jurisdiction as well as maps of their plots. This information, in conjunction with any other maps available through earlier land titling efforts, provides an excellent base for creating a composite mosaic of entire *sindicatos*, and eventually, *centrales* and *federaciones*. The consultant has already experimented with inputting DIRECO survey data into AUTOCAD for the purpose of generating maps. This effort is discussed later in the report.

It is much more desirable to work through the existing system rather than creating competing structures that could be viewed with suspicion by the *dirigentes*, the political leaders of these organizations. The project has already received feedback that the concept of the creation of more new producers' associations has been poorly received by the *dirigentes*. Understandably, the *dirigentes* view them as entities that could potentially dilute their power. Bearing these obstacles in mind, the project should attempt to work through the existing

structures to the extent possible and avoid creating any new organizations that compete with them. If the cooperation of the *dirigentes* is not obtained and the project enters into competition with them for the attention of the farmers, they are likely to try to sabotage the project's efforts.

Joe Lopez, the long-term agricultural extension advisor has suggested a reorganization of the extension system, which is discussed in more detail later on in this report. Mr. Lopez believes that the central/sindicato mechanism is capable of providing data on the following indicators for any given farmer participating in the alternative development program:

1. Total area under cultivation, by crop
2. Production volume or weight, by crop
3. Farmer's family's consumption
4. Gifts to friends and neighbors
5. Produce bartered for farm labor
6. Sales and prices at the farmgate
7. Sales and prices at roadside stands
8. Produce taken by the farmer to regional markets

The use of these community-based organizations is the cornerstone of this data collection method. There do not appear to be any other mechanisms that can match its potential for detail and accuracy.

F. SYSTEM 2: PACKING AND SHIPPING

The recent construction of a cold chamber for bananas as well as the creation of a banana cooperative both provide an excellent medium for collecting data on production and exports. Future plans to build a pineapple packing plant will provide a similar opportunity. Computers might even be located on the premises to help manage the facilities while collecting data at the same time.

G. SYSTEM 3: EXPORTS

At present the export data collection mechanism has not been entirely defined. This will not be entirely possible until the new contractor team is on-site and their personnel are operating the commercialization unit.

However, there are a number of obvious approaches for obtaining data on the export of Chapare products. The producers' associations mentioned above are certainly one way of accomplishing the task.

There may be other ways as well. All exporters must obtain a Certificate of Origin from the Camara de Comercio Departamental or the Dirección de Comercio Exterior. For agricultural products to be exported, a Phytosanitary Certificate must be issued by the Ministry of Agriculture or one of several other governmental organizations. These could also be sources of data. The consultant is not in favor of the suggestion of using the coca checkpoints along the roads for the purpose of collecting data on agricultural production or export.

H. SYSTEM 4: INFRASTRUCTURE PROJECTS

The physical infrastructure projects known *obras de impacto inmediato* are used to upgrade facilities used by farmers and persons involved in commercializing agricultural projects as well as to reward communities who have had a high level of participation in coca eradication activities.

They fall into 5 general categories:

1. Commercialization: Fruit packing plants, cold chambers etc.
2. Urban Improvement: Electrification, cobblestoning, drinking water systems etc.
3. Community Works: Schools, health centers, town halls etc.
4. Water Projects: Flood control structures, irrigation systems, erosion control etc.
5. Transportation: Drainage, platform improvements, surfacing, bridges etc.

Each one of these activities has a special monitoring requirement with a series of unique indicators. The computerized monitoring system designed by Edwin López,

of USAID Cochabamba's Engineering Office is well-designed and will be easy to incorporate into a larger system.

I. SYSTEM 5: TRAINING

Training of farmers takes place through a number of mechanisms such as:

- Cursillos
- Dias de Campo
- Ferias del Agricultor

In each of these courses, there is at least one technical theme that is extended. In some cases, farmers attend the sessions in order to receive the certification necessary to obtain credit to purchase agricultural inputs.

IBTA's data covering farmer participation at project-sponsored events in the Chapare is quite good. At IBTA, the names and ID card numbers of all of the participants are included with the support for the expenditure, so that the accounting system is a natural capture point for this data. Since there are expenses associated with each training course, the information regarding the details of the course generally accompanies the vouchers processed for payment. At PDAR's high valley projects, this information will soon be obtained using the new monitoring and evaluation software designed by DAI consultant, Steve Rosholt, which relies on the periodic submission of reports by field personnel to collect the critical indicators necessary for evaluating project performance.

J. SYSTEM 6: EXPERIMENTAL STATION ACTIVITIES

At the experimental stations there are three well-developed functions that take place: research, production and extension. Because these systems have been operating for some time, there is a considerable body of data covering indicators for these activities. This information is discussed in detail in the consultants 8/31/91 report. It should not be difficult to write the specifications for this area.

K. SYSTEM 7: CREDIT

In contrast to other typical credit programs, CORDES' system must track the performance of profit-making enterprises that are participating in various aspects of the alternative development process. This covers firms such as canners and juice producers and other businesses involved in the transformation of agricultural products originating in the Chapare. It is important to be able to monitor the

profitability of entire categories of businesses in order to be able to make credit decisions regarding other enterprises of a similar type.

Technical assistance will be useful to help ACIDI modify their existing systems to incorporate the additional requirement of soliciting, recording and analyzing information regarding for-profit enterprises.

L. SYSTEM 8: NGO'S AND PVO'S

Each NGO and PVO will have to be interviewed individually to understand the nature of its activities and its information needs. The approach to create a reporting system for these organizations is to identify all of the common denominators amongst principal indicators, so that consolidations can be made and a conclusion drawn about the performance of the ensemble.

M. SYSTEM 9: FINANCIAL MANAGEMENT

1. **Budgeting:** The budgeting structure for all project-funded organizations needs to be standardized. At present PDAR and IBTA use different methodologies to build up their budgets. The structures do not resemble each other and cannot be consolidated. In cases where compatibility with a system higher up must be maintained, the structure at the project level needs to be a common denominator. Above all, the budgets need to retain compatibility with the SAFCO chart of accounts, which will be the basis for all Bolivian government reporting in the future.
2. **Accounting:** In the past, concurrent non-federal audits as well as RIG reviews have made recommendations regarding the need for improvement in accounting procedures and internal controls. Several measures to correct the deficiencies are in the process of being implemented. It is essential that these efforts take into account the large vision of an integrated management information system. This is important to avoid the need to dismantle these systems at a later date. The efforts should focus exclusively on bringing the various accounting systems into full compliance with AID requirements, but should not upgrade or modify any computer hardware or software.
3. **Price Waterhouse/Moreno Muñoz IQC:** During the consultant's meeting with representatives of Price Waterhouse's management consulting group, it was made clear that they did not consider the creation of new software to manage PDAR, IBTA or SNC's accounting to be a rational step towards correcting the problem. They said that they would be submitting a counter-

proposal that emphasizes the fundamental steps in establishing any manual accounting system. Specifically:

- a. Perform a detailed analysis of the existing system, as it presently stands.
- b. Determine the system requirements and create a design prototype.
- c. Write procedures manuals for all major functional areas: Purchasing, disbursements, inventory etc.
- d. Train the project personnel in the use of the system.

The consultant concurs wholeheartedly with Price Waterhouse's opinion that improvement of the existing software or creation of new software before the above manual procedures are established is premature and beyond the scope of this effort.

4. Belmonte y Asociados' Accounting Software: At present, both PDAR and IBTA are running an accounting package supplied by a local developer, Belmonte y Asociados. This software was originally developed for other clients in the private sector. The general ledger was designed to manage a bank and the inventory management system, which operates off-line from the rest of the system, was written for a retailer. The Belmonte software used by PDAR has experienced numerous problems which put in question its appropriateness for that organization. Because it was designed for a private-sector financial organization, it has difficulty incorporating the needs of a public sector development project, forcing the accounting staff to supplement its standard reports with considerable manual analysis. Furthermore, it has been reported to "lock up" on occasion, causing loss of data.

The program is written in dBASE and compiled with Clipper, which are both obsolete technology. The consultant was formerly a beta-tester of dBASE accounting software. His experience with this sort of a package is that the code tends to be unstable, it is very difficult to modify and is practically impossible to debug. It is the consultant's recommendation that USAID not invest any additional resources in this software and that a replacement be sought out during the specification-writing phase described later on.

3. **Audit:** At present, the public accounting firm of Coopers and Lybrand is under contract to perform ongoing concurrent audits of all activities employing funds furnished by USAID. This is useful in providing management with assurances that the numbers in the financial statements can be supported. However, concurrent audits must also have an operational focus. It is not sufficient to simply ascertain that every transaction is supported by a piece of paper. It is necessary to look beyond the mere mechanical aspects and evaluate the substance of the transaction.

The consultant discussed this topic with AID Cochabamba's Financial Analyst. An example of an improved audit report structure was prepared for him by the consultant. The Financial Analyst would benefit considerably from some training in the use of electronic spreadsheets, such as Lotus 1-2-3 or Quattro Pro. It is important that he be provided with a computer system in his office, as all his worksheets are presently prepared by hand. Computerizing this operation would increase his productivity and allow him to leverage his time more effectively.

N. SYSTEM 10: PARTICIPATION OF WOMEN

Information concerning the involvement of women in overall project activities will be obtained from a number of sources. The data covering training activities will identify the number of women trained in various agricultural skills. The information gathered through the new extension system will have a record of the number of women promoters recruited by the project, which is supposed to increase by 50% over the life of CORDEP. The credit unit operated by ACDI will know the number of loans issued to women or women-owned businesses. All of this information will be consolidated into a periodic report which will give management a global overview of the progress towards the goal of increasing the participation of women in project activities.

O. SYSTEM 11: ENVIRONMENTAL MONITORING

The project paper specifies reporting on controls over environmental degradation. The crop acreage and production monitoring system will provide data regarding the pattern of clearing of forested areas as well as reforestation efforts. This, combined with data from other programs, will complete the picture of the overall effect on forested lands.

The consultant's report from last summer dated August 31, 1991 discusses the methodology of using the networked database model to track pesticides and toxic chemicals from their point origin to their final destination. (See Page 24 of last

year's report: "Technical Aspects of Database Design") If the field inventory control system is designed in this fashion, a tracking mechanism would be easy to set up.

P. NEW AGRICULTURAL EXTENSION METHODOLOGY

The cornerstone of the production data gathering system is the plan advanced by farming extension advisor Joe Lopez, who has over seven years experience working with farmers and community organizations in the Chapare. The plan proposes to reorganize the agricultural extension function around the established community structures, thus leveraging the extensionists' efforts through cooperation with the *promotores*. This concept fosters better exchange of information in both directions--from extensionist to farmer and vice-versa.

The methodology of working through these organizations has been validated over recent years as an effective way of obtaining farmer cooperation, communicating alternative development themes and generating interest in programs sponsored by the project. In the past, thousands of farmers have been drawn to events which were publicized through the organizational network.

The communities comprised of farmers that have actively participated in the alternative program should not be resistant to the idea of providing information to IBTA or USAID. After all, when they agreed to reduce their coca plantations, they permitted DIRECO officials to visit their plots and create detailed maps of their coca. In this sense, there has already been full disclosure on their part. What the new plan proposes is to supplement the existing coca data with new information regarding crops and harvests so that the farmer can receive a higher level of service from the organizations responsible for improving crop yields and finding markets for agricultural products. There would only be minimal modifications that would have to be made to the existing database in order to incorporate the new information to be collected from the farmers.

The consultant strongly supports this methodology as the principal data gathering mechanism for information regarding the number of hectares in production, the volume of production and the composition of farm sales. In its absence, there is not a clear way of obtaining credible data on farm production levels.

Q. THE DIRECO DATABASE

The Dirección Nacional de Reconversion Agrícola has extensive data covering over 14,000 farmers throughout the Chapare. The information is contained in two separate databases. The main database contains all of the demographic and crop

data for each farmer and the second one contains data relating specifically to coca eradication. In December 1991, the information contained in the first database was ported over to the Informix ISQL platform and queries were performed to test the validity of the data. The analysis revealed discrepancies whereby the sum of the areas of the various crops frequently did not agree to the total size of the plot, suggesting that methodologies for refining measuring techniques will be required.

In addition to the data stored on computer, DIRECO also has a map depicting each farmer's plot. The maps contain references to known landmarks in the vicinity and show the detailed layout of the farmer's coca plantations, highlighting the eradicated areas. These maps are created based on field notes taken by DIRECO surveyors, who walk the fields and determine the distances and bearings using a magnetic compass and a metal measuring tape. Casio handheld calculators running a small algorithm in BASIC are used to close the polygon defined by the field surveyor's measurements, adjusting any errors in the process. The result is a reasonably accurate calculation of the area of coca that is to be eradicated. This figure, expressed in hectares and carried out to four decimal places, is the basis for providing monetary compensation to the farmer for the eradication of his coca, as provided for by law. The calculated area is not 100% precise, because the measuring and area calculation techniques do not take into account any topographical relief of the plot.

Meetings with DIRECO technical staff members in Cochabamba were very informative. They affirmed their interest in cooperating with other organizations working in the area of alternative development. The data processing function at their offices appeared to be well-organized and staffed with competent personnel.

R. THE RURAL HOUSEHOLD SURVEY

The Rural Household Survey was a useful exercise for learning about the general profile of farmers in the Chapare. However, it is not an appropriate tool for long-term monitoring and service delivery.

The measurement of areas in cultivation is not being done solely for statistical and reporting purposes. More importantly, it is being done for the purpose of facilitating hands-on management of project activities. Accordingly, the data must be accurate, timely and verifiable.

If the characteristics of samples have to be extrapolated to the universe, it would be preferable to do this from an verifiable base, such as the total number farmers reporting through the *central* mechanism. This would most likely include a much larger sample, although the randomness aspect would be lost. It is anticipated that a majority of farmers will elect to participate in the data collection exercise.

However, there will probably be some holdouts and it will be necessary to estimate the acreage and production based on what is known about other farmers with similar attributes.

There are a number of reasons why a statistical survey is not a substitute for a permanent, exhaustive, systematic data collection mechanism:

1. **Forecasting:** Because of the wide variation in the characteristics of soils and climate in the Chapare, a sampling survey with a limited number of respondents is not likely to be effective in estimating harvests. As was demonstrated by the project's experiences in 1991, accurate forecasts of produce available for delivery are critical in generating credibility with exporters and processors, who themselves must plan their volume sometime in advance. Under the special conditions prevailing in the Chapare, statistical sample is simply not an adequate tool for creating a credible forecast.
2. **Service Delivery:** An important argument in favor of the collection of production data through a comprehensive plot registration effort is the ability to use the same structure as a means of delivering services to farmers and to provide follow up. Farmers who have agreed to reduce their coca need to receive the benefits they are entitled to under the law, as quickly as possible.
3. **Timeliness of Information:** Due the changing nature of the processes at work in the Chapare, it is necessary to have a dynamic system in place that is capable of quickly capturing changing patterns in agricultural trends. This is of special importance in order to document the transition away from coca farming and the adoption of sustainable commercial crops. Furthermore, it is not reasonable to expect that a new survey can be conducted every time additional data is required. There is considerable lead time associated with launching the teams as well additional time required to analyze the data. Also, at some point, the farmers may tire at the sight of yet another survey-taker at their doorsteps.
4. **Data Integrity:** Because of the importance of data to project managers and the high visibility of the project, it would be desirable to have a system that provides an audit trail to support the numbers that are submitted to management and outside organizations that are monitoring project results. This would permit verification by third parties and would give comfort to management that their data will stand up to audit in the same way that the accounting numbers are required to.

5. **Farmer Cooperation:** Repeated survey taking over time may well create the impression of excessive government control, and may spawn a negative reaction among farmers, causing a withdrawal of cooperation. As farmers are polled time after time, they may question the wisdom of continuing to provide information, especially if this is not linked to any particular service delivery to them.

S. COMPUTER HARDWARE

1. **Project Headquarters:** The Novell local area network purchased by PDAR is now operational, although no applications are running on it at this time. The proposed integrated information system is clearly the most important application to be installed, as it has the greatest potential for benefitting multiple users throughout the organization. As discussed later on in this report, the technical analysis for the software requirements has concluded that the Informix 4GL running on a UNIX platform is the preferred option. This will necessitate some changes to PDAR's file server specifications. The most practical solution will be to implement the VP/ix environment on PDAR's LAN, whereby the UNIX operating system acts as the primary operating system, providing the multi-tasking, multi-user foundation for the network. The Informix databases would run on this system. Standard MS-DOS applications can also be run during a UNIX session by invoking the DOS operating system through the VP/ix environment. VP/ix provides a transparent integration of the DOS and UNIX file systems, so that any program, regardless of whether it is running under DOS or UNIX, can access and share the same files. In short, this allows the best of both worlds to coexist in the same system.

These changes have been discussed with Edwin Mirabel, the new data processing professional hired for PDAR, who has experience installing and configuring these systems and who should have a major role in performing the modifications or enhancements to the NCR-Novell LAN. Since Mr. Mirabel was a former systems engineer at NCR and is very skilled in numerous advanced database development platforms, it would be hard to find a more qualified person to help PDAR fine-tune its hardware and software systems.

2. **Project Field Locations:** As discussed in the consultant's first report dated August 31, 1991, there is a serious need to upgrade the computer hardware used at field locations. The experimental stations are important sources of technical and financial data and should be provided with updated computer hardware. With the forthcoming arrival of electrical power to the Chapare, there are no other major obstacles to implement modern computer

equipment in areas where it is needed. At the same time the database specifications are determined, the computer hardware needs can also be established. At present, it is not possible to be precise regarding the units required for other locations, such as producers' associations and packing plants. However, it should be anticipated that at some time in the future, some aspects of their operations will be automated and their data fed into the main integrated system.

3. **GOB Organizations:** Some Bolivian government organizations will be providing important inputs into the system. It is possible that hardware and software at these locations will have to be upgraded in order to obtain acceptable performance as well as compatibility with the main system used by the project. Likewise, other Bolivian organizations are recipients and end users of information generated by the project and will need to have compatibility with the systems that are providing the data.

T. GEOGRAPHIC INFORMATION SYSTEMS

1. Immediate Applications:

Annex 3 is copy of the DIRECO map referred to in Section Q. It is a manual drawing of a plot belonging to a farmer who is participating in the alternative development program. The lines that describe the eradicated coca and remaining coca are constructed using the field measurements taken by DIRECO surveyors and agronomists. An example of these can be found in Annex 4. These notes are composed of a series of vectors that define the magnetic heading and the distance on each side of the polygon that encloses the particular plot of coca. The following drawing, Annex 5, shows two subsections of the map contained in Annex 3. Subsection (R-1) shows the 0.4160 hectares of coca that were reduced and (M-1) represents the 0.0643 hectares of coca that remain in the ground. This drawing was produced by simply inputting the 19 (R-1) vectors and the 7 (M-1), as contained in the surveyor's notes. The small overlap of the lines observed at the closing point (#1) represents the measurement error that would have to be corrected using a mathematical routine to average it across the polygon. The areas were calculated automatically by the computer as part of the drawing process.

These drawings can be linked to the database of farmers using C routines operating from inside AUTOCAD, thus allowing the user to call any particular plot or collection of plots to the screen. Composite mosaics of each *central* can be created from maps and data available from the farmer organizations, and in some cases, cadastral and titling data could also be incorporated. This will accomplish the project's immediate need for crop and production information, while at the

same time laying the groundwork for integration into a much larger GIS effort in the future. The AUTOCAD .DWG format is an industry standard that can be subsequently imported with ease into any GIS software package, such as ARC-INFO, thus eliminating duplication of work and the need for expensive and time-consuming re-inputting of baseline data.

Maintaining these maps through information obtained through the farmer organizations will provide the project with a very accurate picture of the changing patterns of agriculture in the Chapare.

2. Future Applications:

The consultant's research revealed that numerous organizations working in Bolivia are seriously considering implementation of a Geographic Information System. The needs and specifications vary according to the priorities established by each of these organizations. However, there is significant overlap in the data to be captured and analyzed. The data interpretation and inputting functions are the most laborious aspect of implementing a GIS. Most of the failures of GIS observed by the consultant in other countries was attributable to the inability to capture sufficient data to permit meaningful conclusions to be derived from it.

There are a number of U.S. Government organizations considering the implementation of a GIS system in Bolivia. Among these are USAID, the State Department and UEGS. A "buy-in" between these agencies has been suggested as a means of minimizing cost and obtaining maximum leverage of funds. The consultant also learned that two foreign countries, Germany (GTZ) and the United Kingdom are also contemplating the creation of GIS systems.

It would appear that most of the organizations visited concur that the GIS applications software of choice is ARC-INFO and various other packages that interface with it.

U. COMPUTER SOFTWARE

Up to now, software applications have been developed on an as-needed basis by the various organizations involved in alternative development. Without the benefit of a coordinated master plan, they have evolved on a number of dissimilar software platforms.

At present, applications have been developed using a variety of platforms: FoxPro, dBASE, DBXL, Quattro Pro, Lotus 1-2-3, BASIC, Advanced Revelation and even Word Perfect. Without a unified approach, integration is practically an

impossibility. In order to create a system where data can be exchanged effectively between organizations, it is necessary to select a single applications development platform to be used at all levels.

1. **Platform Characteristics:** One tool for creating large, sophisticated programs is Informix-4GL, a fourth generation language designed specifically for relational database applications. It allows the developer to move quickly from the conceptual stage to a finished application and has the added advantage of being easy to modify or to enhance with additional features. Informix's fourth generation language compiles down to C-source, which is subsequently compiled into executable files, providing for high efficiency at run time. Since it can be moved across platforms without modification, the application can be prototyped on an existing MS-DOS system and ported over to a UNIX environment at a later date, where the communications links can be written. UNIX is rapidly replacing MS-DOS in the corporate world and in the government, and UNIX networks are already beginning to appear at development projects sites in numerous countries. Informix supports over 450 platforms from 85 manufacturers and UNIX versions are installed at more than half a million locations worldwide.

Fortunately, USAID/Bolivia is in step with this trend, since they have already selected UNIX as the operating system for multitasking applications at the mission and at PDAR. The consultants have recently seen UNIX networks operating at AID/Washington and understand the IBM RS/6000 System running AIX, IBM's implementation of UNIX, is now being installed at numerous missions around the world.

After surveying the market, the consultants have elected to recommend SCO UNIX in preference to Interactive UNIX because of the uncertainty of Interactive's future and the direction for this product in light of the recent acquisition of the company by Sun Microsystems. Furthermore, the installed base of SCO UNIX is ten times that of Interactive.

2. **Local Acceptance:** Informix is the most widely used database applications development platform in Bolivia. It is widely used at many private and public sector organizations throughout the country. A list of some of these organizations can be found in Annex 6. In Bolivia, there is an approved Informix dealer who has offices in major cities such as Santa Cruz, Cochabamba, Sucre and Oruro. The offices of Coasin S.R.L. in La Paz are equipped with a number of systems running both MS-DOS and UNIX which permit the technical staff to replicate in their own lab any difficulty experienced by a client in the field. This is important in providing an acceptable level of support to customers running applications on these

platforms. Also, as an official representative, Coasin can contact Informix corporate headquarters in the United States for further help. Upgrades to the software are provided on a regular basis as they are released in the U.S. The technical staff attend routine training courses at Informix offices in the U.S.

3. **Technical Support:** Epsilon markets the entire line of Informix products in Bolivia, performs installations and provides technical support. Actual applications development is frequently performed in-house by the various clients using their own programming staff. However, applications can also be developed by a number of third-party companies in Bolivia such as:
 - Euresis
 - Compusoft
 - Tesis
 - Marshall OSG
 - Edod Systems
 - Nueva Tecnología

4. **Design Flexibility:** Informix's capability of managing dynamic allocation of storage is ideal for recording data where the total number of elements to be captured into a field are unknown or difficult to estimate. For example, a farmer may own multiple plots and have numerous crops planted on each of these, some of them the same, and others, different. A database that provides fields with scrolling lists that can grow indefinitely would be very useful in assuring that all data elements are picked up in their entirety and are available for subsequent consolidation and analysis.

5. **Graphic Interfaces:** Informix databases interface directly with the industry-standard Geographic Information System (GIS), ARC-INFO. Data collected from the field can be fed into ARC-INFO or AUTOCAD so that maps can be updated automatically. Unstructured multi-media data can be stored in a secure format.

6. **Standardization and Security:** With a view towards the future, the systems must be designed with a migration path towards security in mind. Informix On-Line is the only UNIX database vendor who complies with the government's SQL DBMS Federal Information Processing Standard (FIPS) number 127-1. The compliance with this standard is important in securing acceptance by federal agencies. Earlier this year, Informix Software, Inc. was awarded a \$26.8 million contract to provide the database component for a decision support system for the U.S. military. This system will encompass 9,800 sites and 60,000 users.

7. **Superiority over ORACLE:** USAID Bolivia had initially selected the ORACLE database as the platform of choice for creating CORDEP's management information systems. However, there are significant disadvantages to developing applications in ORACLE in Bolivia.
- a. There are very few programmers skilled in ORACLE in Bolivia.
 - b. The costs associated with custom program development and run-time modules are high in comparison with other platforms.
 - c. The fourth generation language used by ORACLE is weaker than its competitors, making modification more difficult. It operates in the interpreted mode, instead of compiling down to C code.
 - d. Due to its large overhead and older database architecture, ORACLE's performance on a network begins to degrade seriously when numerous users are logged onto the system.

V. SYSTEM EVOLUTION

Much of the work already performed in developing applications will be useful in creating the new system. Some systems can be integrated temporarily in their existing forms until such time as they can be recoded on a new platform. Others will have to be created from scratch. The overall system will have to be integrated with established systems operated by other organizations existing within the Bolivian government, such as the SISIN system used by the Ministry of Planning.

Integration with these systems should be a priority for CORDEP, since it is through these systems that official Bolivian government statistics are generated. In the past, USAID has not received proper publicity for its efforts because the necessary data has not been available to the proper channels that furnish information to the media.

W. WORK PLAN

1. **Selection of the Team:** At present, there is an information system committee consisting of representatives of local and international organizations concerned with implementing alternative development. The committee's principal function is to oversee the reporting function. They meet once a month and review and comment on the data submitted from the field. The consultants will work with this committee in selecting the MIS system implementation team. This team will be headed up by the consultant in charge of designing and implementing the new system. The members will be other consultants and staff from each of the organizations that are being linked into the new system. At a minimum, each team will be composed of one consultant or outside implementer and one staff member of the organization being integrated into the system.

2. **System Specifications:** The next step towards creating the new integrated system will be the establishment of the specifications. There will be several steps to this process:
 - a. First, the existing subsystems described in Sections E through O must be documented in detail. This involves creating flowcharts that depict the current information flow from the sources to the collection points and from there to the various end users of the data. The structure of the data must be expressed in terms of type and size of the fields and records that will comprise the database.

 - b. For those areas where there are no subsystems in place at all, a prototype of the necessary structure should be created and discussed with the personnel responsible for furnishing the data to ensure that the requests are reasonable. The flowcharts for data collection and analysis can then be developed.

 - c. Once all of the subsystems have been documented, a proforma master plan for their integration can be conceived in draft form.

3. **Validation of Methodologies:** It will be necessary to test a number of the approaches that are being proposed as part of the overall effort. The most important of these are the subsystems that need to be created in areas where there is no formal data collection system operating in the context of the project.

- a. **The system of collecting data through the *central/sindicato* mechanism must be tested. One or two *centrales* that have a high level of participation in the alternative program should be selected. The *dirigentes* and the *promotores* should be invited to a meeting to discuss the proposed methodologies to be implemented and to learn about benefits that will accrue to the farmers from participation in the effort.**
 - b. **Once the cooperation of the leaders has been offered, the implementation team can proceed to meet with extensionists, *promotores* and farmers to begin to collect the data and assemble the mosaic of maps of the pilot *centrales*. The data structures, which will have been prepared in advance, can be used to capture the data on a laptop computer operating at the field site.**
4. **Development of the Base Systems: Each of the systems described in Sections E through O will have to be modified in some way, and in some cases, created from scratch. During the specification-writing phase, most of these will have been described. Depending on the availability of staff, some of the modifications can be carried out concurrently. Hardware may need to be upgraded at sites where it is too obsolete to be useful. The integration of other organizations into the main system will take place in a series of phases:**
- a. **If the system used by the organization is solid enough to manage the collection and flow of data within that organization, no effort will be made to replace it in the short run, even if it is written in an obsolete language that is not compatible with the overall structure contemplated for the integrated system. Instead, links will be written to the master system and data will be passed in the most practical method possible: floppy disks or flat files transmitted via modem.**
 - b. **Once all of the organizations have been integrated in one way or another, a second phase can begin whereby their software is converted over to the standard Informix MS-DOS platform. This process will be prioritized according to the relative efficiency of each system. Those with the weakest performance will be converted first.**

USAID and USAID contractors. The possibility of creating the position of an "Information Czar" at project headquarters is being discussed.

X. IMPLEMENTATION TIMETABLE

The time required to implement the entire system will be dependent upon the resources assigned to the effort. Because there are so many different organizations participating in the alternative development process, the absorptive capacity of the project for technical assistance of this sort is relatively high. The effort could take up to 18 months to complete, but could be shortened substantially by raising the level of effort after the design phase is completed.

The objective of the implementing team would be to finish the specification writing and pilot tests as soon as possible, which should take approximately 6 to 8 weeks maximum. From then on, the only major limitation would be the availability of personnel to perform the work. Assuming a start up on April 1, 1992, a reasonable target for having the major portion of the system up and running would be year-end, 1992. It is very difficult to estimate the time requirements without having gone through the pilot site tests, which are the principal unknowns in the system. Other external factors will influence the speed of completion, such as the ability to procure hardware and software on a timely basis, as well as swiftness in contracting local consultants in Bolivia.

Y. EXPORT AND FOREIGN EXCHANGE DATA

As mentioned in the consultant's 8/31/91 report, there is a considerable body of data in the field that has gone untapped. The unexploited data that exists in the field and that has not been integrated into project reporting falls into two categories:

- 1. Data generated by project sources: experimental stations or other alternative development organizations.**
- 2. Data collected by farmer organizations: federaciones, centrales, sub-centrales, sindicatos etc.**

While some of the data in the first category can be obtained simply by asking the organization, that in the latter is going to be more difficult.

Initially, there was some hope that data covering agricultural production and exports as well as foreign exchange earnings might be available and this might be used to illustrate project achievements. However, subsequent investigation

revealed that no such data exists, because no significant exports occurred. Even if evidence of such data were to be found, the low level of sophistication of the collection and analysis system is such that it would not be prudent to release the figures to outside sources.

In the absence of data to suggest significant project achievements in exports and foreign exchange, the consultant in the course of his many interviews asked project personnel to describe what they perceived to be the major successes of the USAID efforts to date. The consultant then summarized these in a document which can be found in Annex 7. Most of the comments offered by project personnel centered around infrastructure creation and changing attitudes amongst farmers.

ANNEXES TO REPORT

- ANNEX 1** Persons Interviewed
- ANNEX 2** Terms of Reference
- ANNEX 3** DIRECO Map of a Farmer's Plot
- ANNEX 4** DIRECO Surveyor's Notes Defining Areas of Coca
- ANNEX 5** Farmer's Plot Drawn by the Consultant with AUTOCAD, using the Surveyor's Notes
- ANNEX 6** Partial List of Informix installations in Bolivia
- ANNEX 7** Summary of Project Achievements

ANNEX 1

PERSONS INTERVIEWED

Project Personnel PDAR/IBTA Headquarters

Antonio de Achá, Systems Analyst, IBTA
Hector Herbas, Chief Accountant, PDAR
Edwin Mirabal G., Information Specialist, PDAR (new hire)
Oscar Quiroga, Accountant, PDAR
Roger Ruiz, Information Specialist, PDAR
José Salinas, Technical Manager, PDAR
Francisco Zannier, Director, IBTA
Emilio Zeballos, Accountant, PDAR

SNC/Caminos Vecinales

Victor Obando, Technical Manager
Silvia, Chief Accountant
Accounting and warehouse personnel

DIRECO

Franklin Ayala, Head, Statistics Unit
Gonzalo Jaldin, Systems Specialist
Gustavo Schultz, Systems Specialist

SUBDESAL/La Paz

Eduardo Espinoza, Associate
Roxana Ibarregaray, Director of Planning, SUBDESAL
Magda Lopez Virela, Associate

Technical Advisors and Consultants

Javier Boggero T., Cosicom S.R.L. (Coasin-Informix Reps)
Arvin R. Bunker, Chief of Party, ACDI (Agrocapital)
Oscar De la Reza F., Epsilon S.R.L. (Informix Reps)

Lorenzo A. DeCoste, MIS Manager, MSI/La Paz
Pablo A. Gonzales, Audit Manager, Coopers & Lybrand
Jim Graham, Chief of Party, DAI
Leonora Hamilton, Marketing Consultant, DAI
Larry Heilman, MSI Washington
Joe López, Extension Advisor, Experience, Inc.
Robert Bruce McMullen, Consultant, MSI Washington
Charles A. Patterson, Chief of Party, Planning Assistance
Steve Rosholt, Information Specialist, DAI
Victor D. Santander, Administrative Services, Price Waterhouse
Daniel L. Seyler, Program Associate, MSI Washington
Jorge Terán, Cosicom S.R.L. (Coasin-Infomix Reps)
Bill Stevenson, Marketing Consultant, DAI
Roberto Vargas B., Epsilon S.R.L. (Infomix Reps)

USAID/Bolivia Staff

Jorge Aldunate, Marketing Advisor
Eduardo Aviles, Financial Analyst, USAID/Cochabamba
Edmundo Ballivian, USAID Controller's Office
Melissa Cable, Supervisor, Rural Household Survey
Conrado Comacho C., Engineering Coordinator
Garber Davidson, Deputy Director, USAID Bolivia
John R. Davison, Controller
Marion Ford, Regional Head, USAID Cochabamba
Gerald Fisher, Associated High Valleys Coordinator
Charles Hash, Project Officer, Chapare Regional Development
José Infante, Administrator, USAID
Carl Leonard, Mission Director, USAID Bolivia
Edwin López, Civil Engineering Associate, USAID
Ney López, Former Credit Coordinator, USAID
Stephen Smith, Deputy Program Officer

USGS/Bolivia

Larry Jungman, Technical Advisor, Inst. Geografico Militar

USAID/Washington Staff

**Karen Anderson, LAC/DPP
Sharon Epstein, Bolivia Desk Officer
Ann McDonald, LAC Narcotics Coordinator**

ANNEX 2

TERMS OF REFERENCE

UNITED STATES GOVERNMENT
memorandum

DATE: 9 de enero de 1992
REPLY TO: Garber Davidson, Director a.i.
ATTN OF: *SDJ*
SUBJECT: Colaboración que se brindará al Sr. Donovan P. Rudisuhle en su visita al área del Proyecto Chapare/CORDEP
TO: Distribución

El propósito del presente, es solicitar a ustedes su completa y plena colaboración al Sr. Donovan Rudisuhle durante su estadía en Cochabamba como primera prioridad, puesto que ésta es muy necesaria para el éxito del Programa de Desarrollo Alternativo en Bolivia. Su visita tiene como fin los siguientes puntos:

1. Formalizar los pasos necesarios para el diseño, desarrollo, entrega e implementación del Sistema Integral de Información Financiera/Gerencial para el Proyecto de Desarrollo Regional de Cochabamba (CORDEP), a través de un plan de trabajo que incluye: el nombramiento de personas responsables, tareas a ejecutar y fechas de entrega de cada etapa del proceso.
2. Conseguir información sobre producción y divisas como meta y propósito principales. Dicha información será de mucha utilidad en la Reunión Cumbre Presidencial que será llevada a cabo el próximo mes en Texas, EE.UU., con la asistencia de los Presidentes de Bolivia, Perú y Colombia entre otros invitados.

Agradezco de antemano la mencionada colaboración.

Distribución:

ARD/CBBA: Marion Ford
Conrado Camacho
Jorge Aldunate
José Infante
Eduardo Avilés
Gerald Fisher
Edwin López
DAI: James Graham
Stephen Rosholt
Leonora Hamilton
EI: Joe López

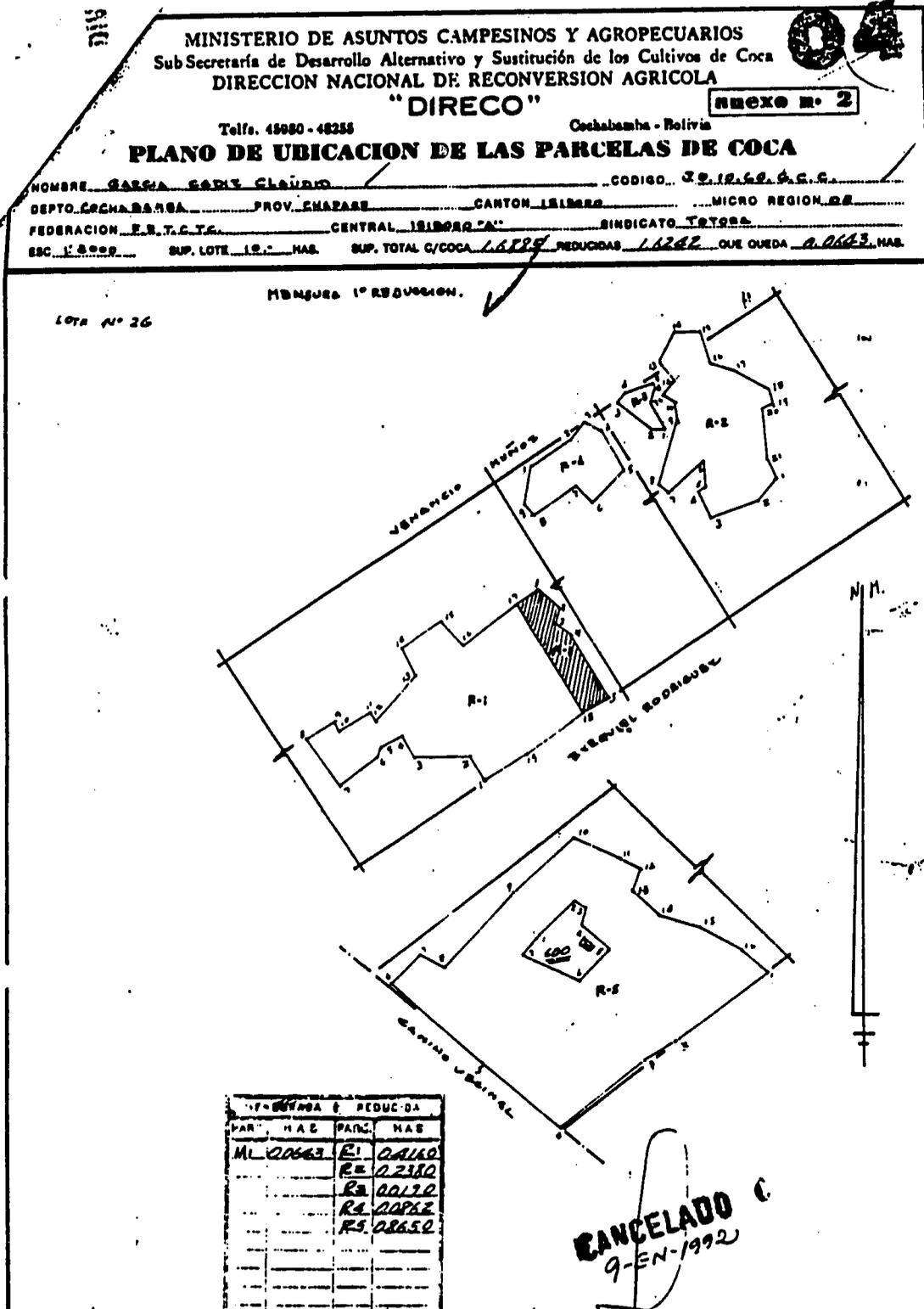
cc: A/DD:RRosenberg
CONT:JDavison
PD&I:LOdle

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GSA FPMR (41 CFR) 101-11.6
5010-116

* GPO : 1984 O - 421-526 (223)

ANNEX 3

DIRECO MAP OF A FARMER'S PLOT



ANNEX 4

DIRECO SURVEYOR'S NOTES DEFINING AREAS OF COCA



①

MINISTERIO DE ASUNTOS CAMPESINOS Y AGROPECUARIOS
 SUBSECRETARIA DE DESARROLLO ALTERNATIVO Y SUSTITUCION No.....
 DE LOS CULTIVOS DE COCA Fecha: 10-11-91.
 DIRECCION NACIONAL DE RECONVERSION AGRICOLA Topografico D.F.R.:
 "DIRECO"

REGISTRO DE LEVANTAMIENTO TOPOGRAFICO

NOMBRE: GARCIA CADIZ CLAUDIO SINDICATO: T.O.T.P.R.A. CENTRAL: ISIBORO "H"

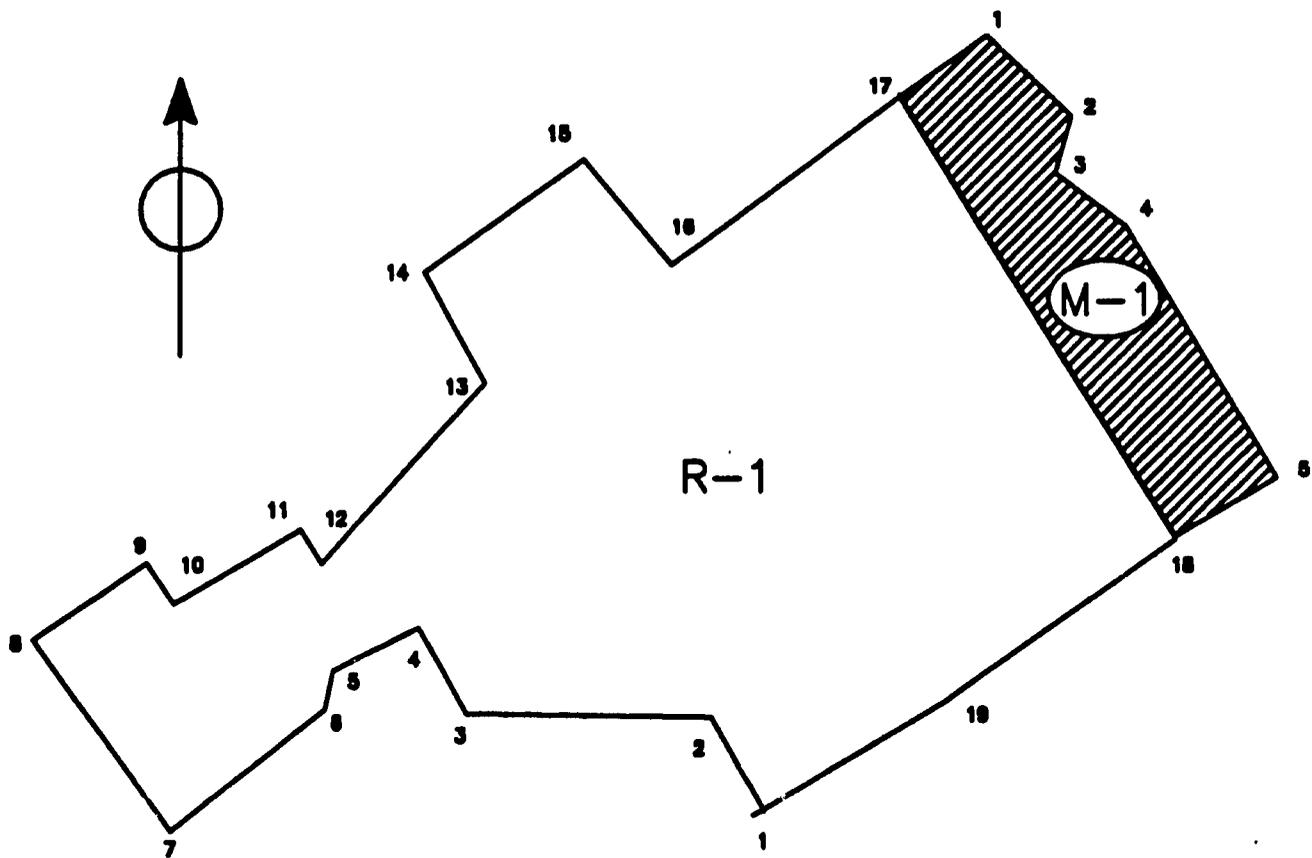
PARCELA	SEGMENTO	ANGULO	DISTANCIA	PARCELA	SEGMENTO	ANGULO	DISTANCIA
	1 - 2	330	11		12 - 13	43	25
	2 - 3	271	25		13 - 14	331	13
	3 - 4	331	10		14 - 15	55	20
	4 - 5	244	10		15 - 16	140	14
R-1	5 - 6	193	4	R-1	16 - 17	54	29
	6 - 7	232	20		17 - 18	148	53.3°
	7 - 8	324	24		18 - 19	235	29
	8 - 9	56	14		19 - 1	240	22.7°
	9 - 10	116	5				
	10 - 11	60	15		1 - 2	221	12
	11 - 12	148	4	R-2	2 - 3	250	22

MINISTERIO DE ASUNTOS CAMPESINOS Y AGROPECUARIOS
 SUBSECRETARIA DE DESARROLLO ALTERNATIVO Y SUSTITUCION No.....
 DE LOS CULTIVOS DE COCA Fecha.....
 DIRECCION NACIONAL DE RECONVERSION AGRICOLA Topografico.....
 "DIRECO"

REGISTRO DE LEVANTAMIENTO TOPOGRAFICO

ANNEX 5

**FARMER'S PLOT DRAWN BY THE CONSULTANT WITH
AUTOCAD, USING THE SURVEYOR'S NOTES**



R-1	Eradicated Area 0.4160 Has.
M-1	Remaining Coca 0.0643 Has.

ANNEX 6

PARTIAL LIST OF INFORMIX INSTALLATIONS IN BOLIVIA

Administración de la Renta Interna
Compañía Minera Inti Raymi
CONALID
Corporación de Desarrollo de Oruro (GTZ)
Corporación de Desarrollo de Potosí (GTZ)
Datagraph S.R.L.
Departamento II del Ejército (Inteligencia)
Droguería Inti
Empresa de Luz y Fuerza de Cochabamba
Empresa Metalúrgica Vinto
Hilanderías Bolivianas
Ingenio Azucarero Bermejo
Instituto Geográfico Militar
Labtek
Lloyd Aéreo Boliviano
Ministerio de Defensa
Ministerio de Finanzas
Mutual y Cooperativa Policial
Programa de Coordinación en Supervivencia Infantil (USAID)
Punto Blanco
Superintendencia de Bancos
Tecnofarma
Telefónica Celular
Universidad Mayor de San Andrés
Universidad Mayor Gabriel René Moreno
Universidad Mayor Juan Misael Saracho
Universidad Mayor Tomás Frías
Yacimientos Petrolíferos Fiscales Bolivianos

ANNEX 7

SUMMARY OF PROJECT ACCOMPLISHMENTS

The Chapare Regional Development Project began activities in 1983. During the 8 years it has been in operation, its principal activities have centered around the creation of both human and physical infrastructures. Training has been provided to extensionists as well as to farmers, providing a framework for propagating the knowledge created by researchers at the experimental stations. The new technologies transferred to farmers will begin to yield better harvests in the future, increasing the volume of products available for both domestic consumption and export.

By design, the project is primarily an infrastructure-building exercise. Its success to date can be measured in terms of the many changes it has made in its area of influence. However, because of the long-term nature of the processes involved, it is not reasonable to expect immediate results that can be measured in terms of farm production and foreign exchange generation. Nevertheless, much of the infrastructure that will create these outputs is already in place and significant results will be observed over the next two to three years. A comprehensive information system that will capture all of the relevant indicators is currently being designed.

The following are some of the project's major accomplishments:

1. The project has fostered a change of attitude in the farmers. The farmers' demonstrated interest in participation in the alternative development program is evidence of the increasing rejection of the *narcotraficantes* and a desire to derive their livelihoods from legitimate agricultural activities. In addition, by facilitating the first exports of bananas and pineapple, the project's commercialization unit has provided solid proof to the farmers as to the viability of exporting their products.
2. The farmers who have been integrated into the project no longer depend exclusively on coca as a source of support for their families. The project has been successful in assisting the farmer in adopting legitimate crops and technologies that have diversified his income base and made him less vulnerable to the unpredictable price swings that are characteristic of the coca business. This has provided stability to the farmer during the recent period of decline in coca prices.

- The new varieties created by the research program will improve yields and provide opportunities for export. In the past, the export market was largely inaccessible to Chapare farmers, because of low crop yields and poor quality. The replacement of traditional *criollo* varieties with new varieties created at the experimental stations will provide the farmers with products that are acceptable in the foreign markets of the neighboring Cono Sur.**

The project recently introduced the export varieties of bananas which should be in production by early 1993. New mandarin, tangerine and orange varieties have been introduced and have been well received by processors and the consumers alike. New varieties of coffee have been planted and have considerable potential for helping a large number of farmers. Approximately 80 HA of macadamia have been planted by farmers in the last three years, and more than 400 HA are presently at the nursery stage. Some of the orchards have already flowered and produced good quality kernels. Ginger and soursop have been introduced and have done well. Last year, ginger was exported to Argentina. An additional 15 HA has been planted in order to serve the export market. Approximately 45 farmers will benefit. Planting materials have been brought in for vanilla, starfruit, cinnamon and coconuts.

The project's aggressive program for diversifying the agricultural base of the Chapare region will provide many new opportunities for increasing farm families' incomes as well generating foreign exchange for the country.

- The project has invested in the creation of a human infrastructure which will contribute to the future agricultural productivity of the area. The families who colonized the Chapare region were not traditional tropical farmers. They were accustomed to very different agricultural practices which are suitable for high, arid lands but are entirely inappropriate for tropical lowlands which are characterized by high rainfall and acid soils. Through the project's training and extension activities, these farmers were familiarized with the appropriate agricultural technologies for this area. This knowledge base would have been very hard for them to obtain on their own.**

5. The building of new physical infrastructure has increased the outlets for products coming from the Chapare. The new road from Chimore to Yapacani has made possible the creation of new markets for Chapare produce in that area, with most of the volume going to the Mercado Mutualista in Santa Cruz, where it is sold on a wholesale basis. The flow of higher quality Chapare bananas and plantains into the Mercado Campesino, a market created by Chapare entrepreneurs, has opened a significant new outlet and is now displacing local produce of inferior quality. The increased vehicle traffic on the new road has resulted in the appearance of numerous roadside stands that sell tropical fruits originating in the Chapare.

An important effect of adding another source of supply has been the stabilization of market prices for bananas and other fruits in this area.

In Cochabamba, the newly completed campesino market is coordinated and supervised by a cooperative in the Chapare. The market provides space for 450 stalls, half of which are already in use, even though the market was only inaugurated on December 15, 1991. This market provides an outlet for bananas, plantains, papaya, oranges and tropical tubers produced in the Chapare on farms owned by members of the cooperative that operates the market.

6. The nutritional status of low-income people has been improved as a result of the availability of low-cost vegetable proteins and carbohydrates. The project has made possible the production and commercialization of tropical food products that were not available in the past. Low-income families whose diets were based largely on higher cost foods shipped in from the altiplano are now able to consume more calories for the same amount of expenditure.
7. The increased availability of tropical fruit products on the domestic market has reduced demand for more expensive imported products, thus saving the country foreign exchange. Before the advent of the project, there was little domestic competition for juice concentrates coming from Chile. Now, juice from fruit produced in the Chapare and processed locally is a common sight in many stores in the area.

The first step in building up an export market is to satisfy demand in the local area. Then, after production volumes increase and quality stabilizes, it is possible to pursue the export business. At present, it would appear that there is considerable foreign demand for many products originating in the Chapare, but there is insufficient volume produced to satisfy the minimum amounts required by the exporters. Project technical personnel estimate that it will be several years yet before significant export figures are observed, as exports only really began in April 1991. However, the import substitution effect is already taking place through sales in the domestic market.