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Concepts for Development of an Agricultural Information
System in Ecuador: Appendix to the Project Paper
for the Agricultural Sector Reorientation Project

FILE

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1.0. Introduction

In a market oriented economy the informed choices of individuals are the best means for allocating resources in a manner that maximizes overall well being. The principal role of the State is to provide a legal system and a set of clear rules regarding property rights, civil rights, and the structure of economic incentives. The State also has other legitimate functions such as providing services where the private optimizing decisions of individuals will not result in a socially optimum level of such services, measured in either positive or normative terms. The acquisition of information regarding the aggregation of the results of private optimizing behavior is one area in which individuals, acting privately, are usually unable to capture the full benefits of such activity, or conversely, the benefit to each individual is very small relative to the cost of acquiring information. In either case, the aggregate level of effort (cost) expended by individuals, acting privately, would result in underinvestment and therefore in a socially suboptimal level of information. Under these conditions, the public, acting through its elected and appointed officials, has a legitimate role in assessing information needs and in using publicly provided resources to provide a socially optimum level of information services.

Ecuador, under its present government, is moving towards increased reliance on the market place for the allocation of resources and away from a complex structure of public involvement in the economic processes of its society. This move is based on the conviction that the market is the best source of information

to guide the resource allocation decisions of private agents-- producers and consumers alike. It is expected, therefore, that with increased (informed) participation by all members of the private sector in the productive processes, economic growth and general well being will ensue at a greater rate and level than under previous systems. The key is to substitute clear incentives and information as replacements for public sector planning so that private agents can plan, act and react.

The need for informed choices to provide the impetus of the market and the fact that information is at least partially a public good require, paradoxically, that the public sector play a larger role in the collection and dissemination of information. In an environment in which the competitive market system provides the incentives for private optimizing behavior, a publicly provided information system can significantly enhance the performance of the private sector through a better understanding by all actors in the market of production, consumption and marketing processes.

Furthermore, the Government of Ecuador seeks to establish clear and fair guidelines regarding the structure of economic incentives to thus promote increased production and improved consumption (incomes) within the private sector. To achieve this, it must formulate, implement and manage policies so as to mobilize domestic resources to their most efficient use within the context of the country's political and social objectives. Enhanced policies and incentives for domestic resource mobilization require careful analyses of possible alternatives and of the structure and performance of economic processes under

past, present and possible future conditions regarding resource productivity and domestic and international market conditions. There is therefore a need for information for private agents and for public sector analysts and policy makers to operate under a structure of improved private sector incentives and an equitable framework for exchange for all participants in the market system.

As part of an economy wide effort, the Government of Ecuador seeks to reorient its agricultural sector towards increased reliance on the market and on private initiative to provide increased production, consumption, employment and export earnings. The principal component of this strategy is to develop policies to guide private sector actions rather than to control them. To achieve this, it will have to develop a greatly enhanced Agricultural Information System for public and private sector use.

This report constitutes a background analysis for the design of such an enhanced Agricultural Information System for Ecuador. It has been prepared for the Agency for International Development as part of the processes for designing a technical and financial assistance project in response to the government's desire to reorient the country's agricultural sector. The report consists of an assessment of the requirements for an information system to promote informed choices by persons trading and producing in agricultural product and factor markets and to promote improved policy formulation by the public sector; a diagnostic of the present information system for agriculture; a presentation of

design concepts for an improved system and a detailed specification of the implementation requirements for such system.

2.0. Requirements for an Agricultural Information System

There exist two broad classes of requirements for Ecuador's Agricultural Information System--those needed for policy formulation and implementation and those needed to guide private sector decisions. Both of these have, in turn, implications for historical, current and projections type information. The following sections present detailed, but not exhaustive, assessments of the needs for these types of information.

2.1. Information for Policy Formulation and Implementation

The main purpose of the proposed project is to re-orient policies to provide an enhanced role for the private sector in determining production and marketing activities in Ecuador's agricultural sector. These policies would seek to mobilize resources into their most productive use, relative to their domestic resource requirement. The formulation and implementation of such policies require information for analyses and evaluation of policy alternatives.

A number of required analyses and issues have been identified as central to the policy formulation and implementation processes. Each of these implies requirements for various kinds of information; these requirements are therefore summarized in the following paragraphs. The information would be used by public and private sector analysts of policies and issues.

2.1.1. Analyses of Efficiency in Resource Utilization

Improved incentives for the efficient use of domestic resources can be developed from analyses of domestic resource

costs relative to international valuations of resources. Two measures of relative efficiency in domestic resource use viz a viz international opportunities are "Domestic Resource Cost Coefficients" and measures of "Effective Protection" to domestic activities. These compare existing or proposed incentive structures for specific commodities against each other and against international market valuations of products and factors. These measures require past, present and, at times, projected information on:

- . Product and factor prices in domestic and international markets
- . Factor costs by specific categories in terms of shares, quantities and prices
- . Exchange rates - official and other
- . Marketing costs - transport, processing, distribution, storage, packaging, etc.
- . Technical factors such as grades, standards, milling and processing parameters, etc.
- . Labor costs and uses by each productive activity
- . Taxes and subsidies for products and factors
- . Cropping and production system typologies
- . Yields and production parameters under alternative processes and at different geographic points within the country
- . Spatial distribution of production within each type of production system and technology.

2.1.2. Other Policy Issues

Other Policy issues require the following kinds of information:

- Fertilizer production and use

Production: Formulas produced by processes for production.

Sources of raw materials, quantities, prices.

Costs of production by (domestic & imported component).

Distribution processes and costs.

Uses: Yield, production effects by crops
formulas used, methods of application
farmgate costs, application costs
storage, financing requirements

- Export Markets for Commercial Crops

- 1) Domestic costs of production at economic (shadow) prices and at market or accounting prices (DRC's versus private profitability).
- 2) Trends and variability in international markets especially international marketing arrangements and dominant importers (GATT rules, Pacto Andino Agreements, etc.).
- 3) Costs of production and other conditions of supply by principal exporters.
- 4) Grades, standards, continuity, packaging and dependability requirements in principal international markets.
- 5) Export financing arrangements.
- 6) Transport and distribution costs.

- 7) "Windows of opportunity" in selected markets.
- 8) Conditions of facilities and infrastructure for processing and shipping, holding.

- Oilseed Policy

- 1) Trends and potentials in domestic production of oil seeds including DRC's.
- 2) International market prices and grades and standards.
- 3) Domestic processing and transport facilities including storage of refined and unrefined products.
- 4) Domestic demand by product type refined for human consumption or input to industrial processes.

- Research Priorities:

- 1) Domestic demand studies, domestic price prospects.
- 2) International market prospects (esp. prices).
- 3) Factor use and costs under alternative technologies and typologies of producing units.
- 4) Climatic, weather, social, ecology factors which may limit or enhance innovation.
- 5) Availability of adaptable technologies from other regions, countries, etc.
- 6) Conditions of extension promotion system.
- 7) Producer and consumer equity considerations.
- 8) Input supply systems - predominant conditions in credit and capital markets.
- 9) Rural labor market conditions including seasonality of labor flows.

10) Product market requirements e.g. grades, standards, seasonality of production, processing and distribution requirements.

- Costs of Production

Are an information resource themselves, but special emphasis needs to be given to factor substitution in response to changes in relative prices, and cost of production under alternative systems for different regions, size of farm, and infrastructure.

- Marketing and Storage Costs and Returns

What are the components of the marketing production function:

Information acquisition, harvesting, grading, packing, transport, assembly, storage, losses prevention, risks reduction, labor at each stage, fuel, materials, taxes, licenses, as affected by external technical and economic inefficiencies.

- Food Subsidies

Consumer expenditure shares by consumer groups; price and income responsiveness by different consumer groups; product substitutes; targetting mechanisms; cost effectiveness of alternatives; nutritional implications of alternatives; household (rural/urban) resource allocation decisions.

- Demand Studies (Aggregate, Crossection/Time series data)

a) National disappearance time series.

b) Time series of National Product and Income Accounts

particularly personal income by sectors and regions.

- c) Household budget and resource allocation studies including household composition.
- d) Food preparation costs (time, fuel, services, processing, milling, manufacture) and service, industrial and farm components in food budget.
- e) Forms of acquisition of key foods, e.g. production on farm, unprocessed with high degree of servicing, processed baked, etc.
- f) Income distribution and growth (cross sections and across time).
- g) Quality service processing and regionally adjusted prices, preferably in quarterly time series.
- h) Deflators/price indices.

Mechanization

- a) Types of equipment for each cropping system and function.
- b) Domestic and international costs of each.
- c) Input/output productivity and unit cost relationships
- d) Fuel, maintenance and labor costs.
- e) Timeliness of availability.
- f) Alternative rental and financing of usage arrangements.

Extension Services (Private/Public)

- a) Land use patterns.
- b) Size distribution of producing units.
- c) Geographic distribution of producing units.
- d) Land tenure and organizational patterns for

agricultural enterprises.

- e) Costs of production for alternative technologies for different cropping systems and land use patterns.
- f) Product and factor prices.

- Divestiture of Government's Enterprises

- a) Conduct, structure and performance of the relevant product or factor market.
- b) Independent valuation studies.
- c) Analyses for externalities which prevent full divestiture or require alternative public sector initiatives.
- d) Financial and financing analyses.

The above lists of information imply the acquisition of data from many sources; some data will come from existing public sector statistical systems, other types will require the enhancements to these systems as proposed in the sequel and still other types will come from bibliographic sources and institutional annual reports, etc. The primary responsibility for acquiring such varied sources of data will rest with the users of the data. It is important that provision be made in the proposed project for the archiving and retrieval of data sources not otherwise included in the proposed formal data bases of the Agricultural Information System.

2.2. Private Sector Information Needs

In addition to clear and stable structures of incentives, private agents can better mobilize resources if they have access to information regarding expected production and current market

conditions. Such information is of use to the public sector, but in a market oriented process it is indispensable to guide private decisions in a fair and equitable manner towards increased production and consumption. These information requirements are for two separate but related systems - crop forecasting and market news and information.

2.2.1. Crop Forecasting System Requirements

The purpose for a crop forecasting system is to provide reliable and accurate estimates of the expected future production of key commodities in time to affect current decisions, by producers, traders, processors and consumers. In a typical situation regarding annual crops, it would be desirable to forecast production of the crop prior to the time in which farmers make their planting decisions and to then proceed through the cropping cycle with adjusted periodic forecasts which reflect actual plantings and the evolution of factors which affect harvested yields. Such forecasts would influence the decisions of farmers to increase (or decrease) their intended plantings of the crop or of competing or complementary crops; of traders to accumulate stocks (or not), to export (or import); and of processors to plan their production activities.

The technologies by which such forecasts are developed are a function of the crops and commodities, the ecology, the nature of the market for the particular commodity, the human and material resources assigned to the information system and the statistical requirements which are specified for the forecast for each commodity. Independent of these factors all crop reporting

systems should include as a minimum the following characteristics:

- 1) A known sampling frame for estimates of aggregate plantings and production are to be developed.
- 2) An agronomic or zootechnic basis for integrating factors for the prediction of yields and production.
- 3) A sampling design with known statistical properties for gathering the data to be used in predicting production.
- 4) Established procedures for quality control of the collected and processed data.
- 5) Processing and disseminating capabilities to insure timeliness and therefore relevance to all users.
- 6) Institutional and organizational arrangements for implementing (1-5) so that the estimates are free from influence of political or vested interest forces and so that they are made available to all actors in the relevant market in an equitable manner.
- 7) The system of prediction should be based on actual data as they reflect conditions as they exist at the time of their acquisition and not on any normative notions of what "ought" to be.

2.2.2. Market News Information

The purpose of a market news information system is to provide accurate, timely and unbiased market reports on current conditions on supply, demand, prices, trends, and other pertinent information regarding trading in agricultural commodities to aid producers, marketers, processors, suppliers, transporters,

retailers and consumers to make informed marketing decisions. These actors will use the Market News Information to determine where and when to buy and sell; a principal purpose is to place buyers and sellers on a more equal bargaining basis.

A functioning market news system must meet the following characteristics:

- 1) It should be based on a standard yet widely understood nomenclature; grades and standards as bases for sales can enhance this function if they reflect the prevalent trade practices and do not attempt to modify the trade practices.
- 2) Such grades and standards must be established with the participation of the affected private sector actors and should not significantly increase trading costs, prices, unemployment nor should they reduce competition, productivity, innovation, investment or the ability of domestic producers to compete internationally.
- 3) The market news system should attempt to report market conditions and not to develop the market, i.e. the private agents will develop the market if the information is accurate and timely.
- 4) A market news system should report the following for the important trading centers for the selected commodities: Prices and recent trends, market activity, supply offerings, demand, and other pertinent information such as droughts, crop damage, etc. which

may affect traders (buyers and sellers) decisions. Except for prices of standardized commodities all other information may be qualitative if the nomenclature is well defined and consistently applied.

- 5) Dissemination of standard reports should be as timely as possible; daily or at least several times per week for key markets and commodities, and through as many media forms as possible, radio, television, newspapers, telex, telephone, bulletins, etc.

2.3. Sources of Sectoral Performance Data

Much of the information needed for policy formulation is historical in nature and can consist of continuous series as well as benchmark or periodic surveys and occasional censuses. Crop Forecasting and Market News Information is current and perhaps predictive, as in the case of crop forecast. These latter two kinds of information can be used to create some of the archival information needed for the former; they should not, however, be designed for this purpose. Any recurring information needs for policy formulation and implementation should be met through specific and purposive data gathering approaches. The reason for this is that to do otherwise presents the risk that the accuracy of the crop reporting system and the market news system (which are principally for the private sector) will come into question if they are also being used to evaluate the success or failure of a policy or other public sector action.

Separate but interrelated entities should operate each of the three major components of the agricultural information

system. Crop and market reports should be provided to policy makers as if they were simply another user and not the user. All the information can be processed through the same computer system but appropriate security safeguards must be provided.

2.4. Criteria for Assessing an Information System

To support decision making by users of agricultural information systems, an information system must have certain characteristics. The criteria used to decide between alternative systems are accuracy, timeliness, objectivity, comprehensiveness, flexibility, expandability, and repeatability. These are described in detail as follows:

Accuracy

Agricultural statistics that are accurate provide estimates that are close to true values. In statistical terms, this means that the sampling errors and the non-sampling errors need to be small. Sampling errors are the consequence of sample survey design and size of sample;

Non-sampling errors are caused by using incomplete sample frames, not collecting data correctly, not entering or summarizing data properly, using ill-defined concepts. Non-sampling errors are usually larger and more important than sampling errors, because they cannot be compensated by statistical design or sample size.

Timeliness

Timeliness refers to the time that elapses between beginning of data collection and the release of results. In this regard,

agriculture is extremely demanding since it is so dynamic; the situation can change drastically in a short period of time. The criterion for timeliness is that information be available prior to the time at which a decision must be taken.

Objectivity

An objective procedure produces estimates that are free from bias, in principle. In statistical language, levels of sampling errors are measurable and non-sampling errors are minimized. An objective procedure is absolutely essential if the data are going to have credibility with the user community.

Comprehensiveness

An agricultural information system must provide data on all important aspects of the agricultural sector to support decision-making. For example, knowing crop area without knowing crop yields will not result in valid estimates of total production.

Flexibility

An agricultural information system must be responsive to the evolving needs of decision-makers. As data begin to be used, there must be feedback from users to the data collection system. For example, more detailed data may be needed on a certain subject or about a certain parameter associated with the agricultural sector for a province. A good system must be responsive to the users and be able to supply the requested data without massive added resource demands.

Expandability

An expandable information system can adapt new technologies into the system without excessive costs.

Repeatability

Surveys run at different times should give results with differences that reflect real changes in the target population and not changes in the method for collecting data. The value and utility of statistical data increase when current and past results can be compared.

2.4.2. Data Requirements for an Agricultural System

In general six main types of data and information are required for an adequate information system in agriculture:

1. Benchmark data every five to ten years; particularly on agricultural census every ten years. The last Agricultural Census for Ecuador was undertaken over ten years ago and some of the debates on data quality center on the fact that the census data on which other analyses are based, are now quite dated. These benchmark data should include as a minimum:
 - a. Physical resources such as land use, soil types, ground and surface water supplies, forest and range resources, topography, climate, and transportation facilities;
 - b. Human resources, including the age and sex composition, skills, income levels, etc., of the population;
 - c. Economic activities such as alternative employment opportunities or other productive endeavors, the

nature of the farming systems, the available technology, and the transportation system.

For policy analysis and program planning and evaluation, these data can aid in identifying the resources to be used, the target groups on which to focus, and the targets to be achieved. They can establish benchmarks against which to measure change at periodic intervals.

2. Periodic data

Farmer/producer behavioral information, including selected farm management studies and examination of input/output relations to learn how producers react to policy variables and to measure the economic impact of such changes. Certain farmer behavioral information can be brought up-to-date every year or so, once a basic understanding based on several cropping seasons has been established. New studies will be needed whenever a new technology is introduced which might lead to major changes.

3. Agronomic and agro-climatic data from various locations at different times of year showing how major crops respond to fertilizer, irrigation, plant density, and other cultivation practices.

4. Current crop and livestock data, including production, area, and yields particularly for the most important crops, supply and prices of fertilizers, interest rates and availability of credit, and storage stocks held by

government and private traders. Good crop data are particularly essential in Ecuador where weather and other forces produce wide variation in yield from year to year.

5. Market news, including volumes of major commodities traded or available in key market places including values (prices) standardized on units and quality of the commodities.
6. Production and economic projections that permit planners and private sector decision makers to look ahead.

3.0 Assessment of the Present Statistical System for the Agricultural Sector

The present agricultural information system, as it were consists of a number of fragmented activities, the value of which is poor in terms of a number of operational criteria, e.g. statistical validity, reliability, timeliness, accuracy, and usefulness. Two non-integrated institutions undertake data acquisition and information processing activities; the results of these activities are poorly disseminated, and frequently contradictory. It would appear that the data is collected for archival purposes, primarily, and not for use in guiding private and public sector resource allocation decisions. Some of the activities, however, are undertaken with a high degree of technical proficiency and these offer the foundation for the design and implementation of a more efficient and useful system.

3.1 Data Collection Activities

Data collection activities for the agricultural sector are incomplete and fragmented, and undertaken within various agencies of the public and private sector. For example, crop-specific data exist in detail from a periodic area sampling survey operated by the Institute of Statistics and Census (INEC); similar crop specific data are also collected by the Ministry of Agriculture and Livestock (MAG). Furthermore, agricultural data are available at the Central Bank, the National Development Bank of Ecuador (BNF), the National Planning Council (CONADE) and the Ministry of Finance. These institutions consolidate data received from either MAG or INEC. For example, the Central Bank

publishes consumer price indices from price data collected, under contract by local universities and processed by INEC. The Central Bank also uses MAG data to create national product and income accounts information (Cuentas Nacionales del Banco Central, 1984). CONADE prepares food balance sheets from production data received from MAG. These food balance sheets have also been used as the basis for an initial assessment of the food and nutritional status of Ecuador (Freire and Polanco 1984). The National Development Bank of Ecuador consolidates data (including average yields, annual calendar of crops, etc.) from MAG. There also exist price and market news reporting activities within the integrated rural development projects. The National Institute of Meteorology and Hydrology (INAMHI) within the Ministry of Natural Resources collects agroclimatic information in collaboration with the National Program of Agricultural Regionalization (FRONAREG) within the MAG. These latter data are intended to be the foundation for a crop monitoring system that is under development.

The data currently collected by INEC and MAG include production data and consumer and producer prices. These data form the foundation of most of the other data activities related to the agricultural sector. Currently production data are collected from several sources within INEC and MAG. INEC collects, analyzes and disseminates results of production data from the area sample frame project known as the National Agricultural Statistical System (SEAN). The Ministry of Agriculture, on the other hand, collects production data through three sources: (1) 130 agencies of the Agricultural Service

Agencies (ASA) and provincial agricultural offices. (2) the national crop programs within MAG (wheat, barley, rice, coffee, cacao, bananas, hard corn, and soybeans), and (3) the private sector (particular crops are African palm, tobacco, rubber, abacum and pyrethrum).

None of these data collection activities meet the criteria specified in the previous section. At the present there are no reliable data for policy analysis nor are there adequate crop reporting and market news systems. There are, however, foundations upon which these could be developed.

3.1.1. Data From the Area Sample Frame Project

The so called National Agricultural Statistical System (SEAN) is based on the area sample frame approach developed by the United States Department of Agriculture and has been partially implemented under funding from the government of Ecuador (through INEC and MAG) and AID with technical assistance provided through the University of Florida RTTS project. Extensively detailed work has been accomplished in establishing the sampling frame, the sampling design, field data gathering activities and computer data entry activities. Data processing problems have prevented the timely dissemination of even the most basic tabulations. There is currently no apparent operational use of the available information.

The SEAN is a joint project established under a cooperative agreement between INEC and MAG; this agreement is due to expire in June, 1985. The stated purposes for SEAN are to describe the structure of production in the agricultural sector and to provide

the information basis for promoting the development of the sector. The project appears effective in achieving a historical view of the former but fails to contribute to the latter.

The first round of data from 1982 were summarized in the United States, at a great expense. Results of this first survey were published in February 1983. Data collection for the second survey was completed (in October/December 1982), but the data summary was not completed until the summer of 1984, and the publication of the results released in December 1984. The third round of data collection began in August 1983 with data summary and publication in December 1984. The fourth round of data was collected through August of 1984 and was due to be published in February 1985. The fifth round of data was collected in September through December of 1984 and summary is presently underway and is expected to be published by April 1985. The sixth round of data collection will be undertaken in mid-1985.

The area sample frame divides the country into segments of approximately two Km². The survey consists of more than three thousand such segments in non-urban areas with stratification based on land use maps developed from aerial photographs and satellite imagery. The SEAN project collects the following data (among others) directly from all producers in each segment in the sample for all crops:

- months of harvest
- area planted
- area irrigated
- area harvested
- production

For animal production the questionnaire includes a breakdown of livestock by species and for bovines by age and sex as well as information on production of milk (quantity).

The crop data are collected for transitory and permanent crops, for mixed cropping patterns and monocropping. The data seek to measure the last six months of production and forecast the next season's plantings.

Implementation of the SEAN system has cost the government of Ecuador over 4 million dollars in the last five years. The principal obstacle in the dissemination of the survey results has been the analysis of the data, though the time required to complete the process of analysis has been reduced from two years for the second round of data to four months for the fourth round of data within a two year period. The cause of this poor timeliness in the first three rounds of data was due to inefficient computer programs for data processing and analysis. For the fourth round of data, INEC personnel wrote more efficient data processing programs in BASIC, and used a program written by the US Bureau of the Census for tabular calculations (COCENS) for analysis of the data. This program does not calculate any measures of variance or weighted moments; therefore, INEC is currently planning to use the Statistical Analysis System (SAS)* for the analysis of the SEAN data. INEC will require technical assistance and training to become proficient in the analysis and in the use of SAS.

* SAS is a registered trade mark of SAS INSTITUTE, INC. of Cary, North Carolina and was developed (at North Carolina State University) under sponsorship of the Southeastern Agricultural Experiment Stations of the US Land Grant University System.

Given the delays in publication of results, the SEAN data apparently have not been used for any purpose by any public or private organization. Furthermore representatives from MAG do not use the SEAN data because they are inconsistent with their own reports. The lack of interest in SEAN data by MAG personnel is such that it has been proposed that MAG not continue its financial support for the effort when the present cooperative agreement ends in June of 1985; after that time, MAG intends to use only the data which are being generated by its personnel.

3.1.2. Production Data Collected within MAG

The principal source of production data gathered by the Ministry of Agriculture is derived from questionnaires which are sent quarterly to the 130 Agricultural Service Agencies. These data are specific for 92 crops and include:

- area planted in hectares
- area lost and cause of loss
- area harvested
- production
- yields, and
- a qualitative assessment of the crops' status (poor, average, good, very good)

The data collection does not follow any statistical design; the director of the service agency completes the form based on his knowledge of the area being served by the particular agency. It is for this reason that the data are subjective in nature. The production data collected for MAG is collected by a MAG field employee whose primary functions include the promotion of

increased production; the veracity of such data is therefore questionable.

These data are processed by hand within MAG and an annual crop by crop summary of production is published. The summary contains total area harvested, total production (metric tons), and yields (Kg/Hectare) for 79 crops for each province of the country and for the country as a whole.

Production data were also collected in 1982 for specific crops in coordination with the personnel of the national programs (cereals, rice, coffee, cocoa, banana, hard corn and soybeans). These data were collected in 1982 based on a list sampling frame developed by INEC from the 1974 census of agriculture. In 1985, only data for wheat and barley will be collected due to the expense of data processing and analysis (estimated to be 500,000 sucres). The surveys contain the following information for various varieties of each crop:

- number of farms
- total land area
- total area worked
- total area planted
- other information related to farming practices.

These data were collected from the producer by the MAG program personnel. The processing and analysis of the data were undertaken by the computer staff at the Polytechnic Institute. The Ministry of Agriculture published the results of the 1982 surveys.

In addition to the production data collected by the MAG

field offices, MAG produces a report for FAO's monthly bulletins. This information is based on reports from 20 provincial offices including qualitative information about rains, crop disease, and harvest information. There is little use of this bulletin currently within the agricultural sector of Ecuador.

3.1.3. Comparison of INEC and MAG Production Data

The numeric values of the agricultural data collected by the Ministry of Agriculture and the National Institute of Statistics and Census vary greatly within themselves and between the approaches. A comparison of the data is difficult due to the large differences in sampling methodology, data collection practices, and analysis techniques as well as differences in units of measurement. Nevertheless, such a comparison illustrates the problems in performing any information or analysis task with either set of data. Table 1 presents comparisons of SEAN and MAG data for 1982 and 1983 for cereal crops.

It is notable that not only does the SEAN sample survey data differ from the MAG/ASA data, but the two survey sample data sources also vary within themselves from year to year. This may be due to the sampling frame differences of each sample, ie. the SEAN area sampling frame was recently developed through aerial photographs of the country whereas the sampling frame for the national program data was the agricultural census in 1974. For the rice crop in particular, the total national production in metric tons and the yield in Kg per hectare are not substantially different between the sample data and the subjective data from

TABLE 1 - PRODUCTION DATA FOR SELECTED CROPS IN 1982 AND 1983

		<u>1982</u>	
		SEAN	National Program Sample
<u>Wheat</u>			
Area Harvested (thousands of Ha)		6.4	32.6
Production (MT)		5794.4	38297.9
Yield (Kg/Ha)		905.4	1175.9
<u>Barley</u>			
Area Harvested (thousands of Ha)		11.7	34.6
Production (MT)		6582.2	35347.0
Yield (Kg/Ha)		562.6	1051.4
		<u>1983</u>	
		SEAN	ASA's
<u>Wheat</u>			
Area Harvested (thousands of Ha)		31.6	25.7
Production (MT)		17315.7	26914.0
Yield (Kg/Ha)		548.0	1045.0
<u>Barley</u>			
Area Harvested (thousands of Ha)		44.4	29.8
Production (MT)		17922.0	29589.0
Yield (Kg/Ha)		403.6	994.0
<u>Rice</u>			
Area Harvested (thousands of Ha)		121.9	94.8
Production (MT)		273496.3	27350.2
Yield (Kg/Ha)		2243.6	2883.0

the ASA's. The production data collected through the SEAN project appear to be collected in an efficient manner with controlled quality at data entry. The analysis of these data needs improvement which could be accomplished through training and the inclusion of the skills necessary to analyze agronomic data from large surveys. The validity of the results can be assessed only after the appropriate statistical analysis of data quality is conducted. With the results in tabular form only, as they are published currently, it is difficult to ascertain their quality. Because the SEAN results differ from the production data collected by MAG, persons within MAG have tended to believe their own data rather than the INEC sample data. This tendency to distrust the SEAN data is unfortunate for several reasons:

- (1) the extensive scientific sampling approach at INEC was carefully designed to assess the agricultural sector with measurable statistical error; this has not been understood or recognized as correct by the MAG;
- (2) the data collection techniques (which employ interviewers who are independent of MAG) are not recognized by MAG as producing more objective assessments from individual farmers; and,
- 3) the data from SEAN is not investigated in detail by agronomists at MAG (i.e. little feedback is received from MAG).

If SEAN data is to ever be useful, it is essential that the Ministry of Agriculture provide adequate agriculture science support to INEC. Unless this interaction between institutions is

improved, the scientific survey data collected by INEC will not be fully utilized by the Ministry of Agriculture and in the opinion of the writers an important potential will be foregone. This potential cannot, however, be realized without improving the processing capacity at INEC and the appreciation of statistical methods and procedures by the potential data users at MAG.

3.1.4. Price Information

Price information is available at the consumer level at INEC and the Central Bank, and at the wholesale and producer level at the Central Bank and MAG. Consumer price data is collected by INEC in collaboration with the Central Bank and the Universities of Guayaquil, Portoviejo and Cuenca in twelve urban cities throughout Ecuador (six coastal and six Sierra), each having 10,000 or more inhabitants. The sample is based on a frame developed from the "Encuesta de Presupuestos Familiares del Area Urbana" conducted in 25 cities in 1975 through 1976. The price data is collected monthly from middle and low income households. INEC in collaboration with the Central Bank publishes monthly price indices by region, city and expenditure groups (e.g. food, housing, etc.). (Indice de Precios al Consumidor, Area Urbana, 1985). MAG uses food price data produced by this effort to produce a monthly situation report for the Minister of Agriculture.

Some price information of commodities traded in the regional markets is also available at the field offices of the MAG. These data are fragmented and forwarded to the central office on an irregular basis. The resulting information is narrowly

disseminated and of little or no real value. None of the prices and/or indices represent any known sales volume or grade standard for an individual commodity. The integrated rural development projects of SEDRI have developed an apparently useful market price collection system. It is not widely used, however.

Information on international trading prices of commodities controlled by the Andean Pact Countries is exchanged daily via telex with each country. The present reporting, transmission and receiving of this data is conducted by MAG and is somewhat cumbersome. In every province, field representatives of MAG go to the central market area to collect the prices (the day of the week is dependent on the particular market). The prices vary both by day of the week and time of day. This information is disseminated internally at MAG (national program directors, etc.) and to key industrial firms (marketing agents, local universities) and provincial offices, though it is often historical data rather than news by the time it is received. In addition, MAG has attempted to disseminate via mass media the current marketing information, though this has met with little success.

Producer Price Data

Since 1978, producer prices have been collected on a quarterly basis by the 130 Agricultural Extension Agencies (ASA) throughout the country. Each agency provides data from five producers within his area (the representative of the ASA selects the producers to be interviewed). The forms (5 per ASA) are then forwarded to the central office of MAG in Quito for processing,

analysis and dissemination of results. Currently data are being collated and analyzed by hand. The published results contain quarterly prices and average annual prices for 69 products for each province of the country. The national level prices (sucres/Kg) are weighted averages of the twenty provincial level prices, weighted by percentage of production of the commodity. These data are published annually by MAG, approximately six months following the end of the year. Currently, these data are time consuming to consolidate. With some computer technology and technical assistance in analysis these data could be published in a more timely manner. A problem would persist, however, since the basis for computing the averages is the subjective information from the production reports.

3.2. Institutional Capabilities

The two key institutions that are currently collecting, processing and disseminating crop-specific agricultural information are the Ministry of Agriculture and the National Institute of Statistics and Census. The capability of the personnel in each institution varies as do the computer facilities. In addition, other users who analyze and disseminate the agricultural information (e.g. Banco Central, CONADE, BNF) also have their own computer facilities and personnel. The capabilities of the key users of agronomic data are summarized in Table 2; the table also presents an assessment of whether or not these institutions need long or short term assistance in terms of either personnel and/or computer facilities. (The definition of the specific means of assistance follows in a subsequent

TABLE 2 - CAPABILITIES OF THE KEY USERS OF THE AGRICULTURAL
INFORMATION SYSTEM AS ASSESSED IN 1985

<u>Users</u>	<u>Technical Capability</u>				<u>Computer Facilities</u>		
	<u>Statistical Design</u>	<u>Data Col- lection</u>	<u>Data Pro- cessing</u>	<u>Data Anal- ysis</u>	<u>Hardware</u>	<u>Data Pro- cessing</u>	<u>Software Data Anal- ysis</u>
MAG	L	M,L	M,L	M,L			
INEC	X	X	X,S	X,S	IBM 43331,N	Basic	SAS
CONADE		S	S	X,S	X	SPSS	SPSS
Banco Central				X	IBM4341		SAS
INAMHI		X	X				

X = currently has capability

M = manual

L = needs long term assistance

S = needs short term assistance

U = needs updating current hardware for efficiency

section). This chart provides a basic guide to the recommendations for implementing a reliable agricultural information system in Ecuador.

3.2.1. Capabilities within the Ministry of Agriculture and Livestock

The current information system developed within MAG uses data collected, processed, analyzed and disseminated through manual efforts within the Division of Information and Statistics in the Directorate of Planning. The Division of Information and Statistics has fourteen personnel composed of seven professionals and seven non professionals including the director, one economist, three professional agronomists, two administrators, two graduates in economics, two statistical clerks, two agronomists and one secretary. Three of these persons (two agronomists and one clerk) are assigned to work with the processing of the SEAN data at INEC.

In addition, the economist of this division works one day per week at INEC. This collaboration in the processing of the SEAN data is very important for reliability of the quality of the data; however, it is extremely important to also have joint collaboration between the two institutions at the phase of analysis of the data. It is essential that a decision maker who understands field survey work, agricultural data and analysis of data be responsible for final approval of the SEAN survey results. For example, during the analysis phase of the SEAN data, a MAG representative with both analytical skills and knowledge of the agricultural sector in Ecuador should decide which data are outliers, which forms have been incorrectly coded,

how the data will be presented, etc. This step is essential prior to final tabulations and dissemination of results. Unless the MAG provides this skilled person to INEC, the validity of the SEAN survey will continue to be questioned by MAG, and therefore by the remainder of agricultural data users in Ecuador.

Within the structure of reorganization currently underway in MAG, a Directorate of Information is being considered to be setup as a unit subdivided into three divisions: statistical design, data collection and data processing. It is hypothesized that these divisions will require eight, fifteen and ten employees, respectively. These employees will be recruited or transferred from divisions which are currently being reorganized (in other words, current employees of MAG will be moved to the Direction of Information). It is unlikely that hiring of new employees will take place in the near future, given Ecuadorian labor laws and fiscal constraints. The analytical capabilities of the current employees need substantial improvement before MAG can be an institution which is operating a valid and self-contained information system. The data processing and collection capabilities of personnel at MAG may currently be sufficient to manually process data as is currently being done, however, due to the subjectivity of the MAG data, it would be preferable to collect and process data at INEC. Currently the Ministry of Agriculture does not have any computer facilities. The data which are collected by MAG (production and price data) do not require large computer facilities; the essential requirement prior to mechanization is the knowledge of how to use the data,

design valid techniques for data collection, and analyze and interpret valid survey data. Unless these skills are acquired, the collection of more precise data in a more objective and timely manner should not be considered. It would be unfortunate to "mechanize" the current system without changing the form of data collection, the questionnaires themselves, and the use of the data.

3.2.2. Capabilities within the Institute of Statistics and Census

The Institute of Statistics and Census (INEC) provides technical assistance to public and private sector institutions through data sample design, data collection, processing and analysis. The institute has a department of data processing, a data collection department and a department of data analysis.

The collection of the SEAN data is conducted by local interviewers trained by INEC personnel. The processing of the data is conducted in Quito, the processing has been revised between the second and third round of data due to inefficient programs of the first rounds of data. Staff in the department of data processing in INEC have written a menu-driven program in BASIC language which edits the data at the time of data entry. This editing phase assures that questionnaire not to be entered into the computer system unless the data have valid values. This capability is excellent and essential for valid information. The data files have been organized at INEC in the most efficient way possible for storage of large data files. (i.e. variable block records which allow for missing data). The SEAN data is divided into provinces for analysis due to the large size of the data and

the relatively small computer facilities at INEC (IBM 4331).

The computer facilities at INEC are IBM equipment (an IBM 4331) with full screen IBM editor terminals (IBM 3260) for data entry and analysis. This equipment needs to be upgraded for efficiency of management of large data files, since it now takes many hours to compute the tabular results of the SEAN project. The software capability at INEC is adequate; they have used SAS for analysis, but their contract with SAS Institute Inc. has expired and they do not have dollars for its renewal. The personnel need short term training in data management and analysis with SAS. Only two persons have used SAS.

4.0. Implementation Requirements for a Proposed Agricultural Information System

~~It is proposed that an~~ ^{The} Agricultural Information System ^{well} be established through the strengthening of existing institutional capacities at MAG and INEC, and that efforts be undertaken to modify the philosophy towards data that exists at MAG. Furthermore, it is proposed that the system be designed and implemented according to the principles of "distributed data processing". Specifically, this concept implies that data gatherers and users operate in a decentralized fashion to the extent possible, with a large scale and central facility serving principally to re-distribute data and information among users and to insure standards of statistical validity and data integrity.

The proposed system would consist of three major components: 1) Crop Forecasting System, 2) Market News System and 3) Sectoral Performance Data System. The first two would serve primarily as services for the private sector, but would also serve to provide timely information for policy management and monitoring within the public sector. The sectoral performance data system would be a distributed data system that would serve the information requirements of the various MAG programs and related private and public sector groups. The distributed data system would be integrated through the sampling designs developed by INEC and would be compatible in statistical and other terms with periodic and specific data gathering activities of INEC and MAG. For example, a cost of production survey for rice would be designed in collaboration with the Rice Program at MAG, the data would be collected by INEC personnel, data quality would be audited by

personnel from the Rice Program. Once the user files were developed at INEC in collaboration with MAG, the files would be under the control of the Rice Program and MAG, but would be available to all users - private and public. Only directories (e.g. SAS "CONTENTS" with full labels, formats and data set histories) of available data would be maintained for general use at INEC and MAG central offices.

All such specific files could be accessible under prior authorization by all other groups of data users. Specific data needs for policy analyses would first be met from the existing program and departmental files; those needs not covered in this manner would be incorporated into the data collection activities of SEAN or would be provided from other users/collaborators of INEC. All these efforts would be coordinated by a small but high level central information directorate at MAG which would be staffed by one or two highly qualified and broadly trained persons who would also be supported with private sector and expatriate technical assistance. This directorate would control the budget for payment of services to INEC and the assignment of hardware within MAG.

In order to maximize the operational efficiency of an information system for the agricultural sector, it is essential that the two institutions who are currently gathering and processing data (MAG and INEC) collaborate in an effective manner. This collaboration requires joint appreciation for the respective institutions; in turn, this appreciation for the skills of the other institution cannot be realized unless training in the respective discipline is undertaken at each

institution. For example, the Ministry of Agriculture should acquire basic skills and appreciation of statistical issues in sample design, data collection and processing whereas INEC should be assisted to appreciate the technical capabilities of the agronomists and other technical personnel at MAG. In this way, a joint collaborative effort will produce an operationally effective and valid information system. The proposed agricultural information system draws upon the technical skills acquired by each institution in the past few years. INEC should be strengthened in its data gathering and processing capability, particularly with respect to timelines, and MAG should be strengthened as a user and disseminator of data.

4.1. Institutional Arrangements

It is proposed that the Ministry of Agriculture develop a data information coordination center through which all information related to the agricultural sector are compiled and disseminated. This center would be the primary if not only responsibility of the (existing) Information Directorate.

The information directorate of the Ministry of Agriculture will serve as a focal point of all information activities of the Agricultural Information System; the principal role of the directorate will be to serve as a brokerage point for all information systems needs. The information directorate will coordinate all external (Ecuadorean private sector and international) technical assistance and consultancies to MAG and INEC. It will have budget control for equipment and service acquisition. It will administer and supervise with technical and

voucher authority all contracts for equipment and services, particularly all collaborative arrangements with INEC.

Its primary function will be technical, however, and its principal base of authority will be knowledge. Its staff will be trained and assisted to know how to solve data related problems and where data sources are deployed. To achieve this, it will be assisted, from one to two years, by a highly experienced applied statistician who possesses excellent skills in modern statistical computing and data management software, e.g. SAS. The professional staff will consist of two or three highly motivated professionals who understand, at least collectively, the functions of the reorganized ministry. Secondary to this understanding will be their respect for statistical methods. They need not be expert statisticians, but they will need to demonstrate operationally an understanding and respect for statistically sound methods of data gathering, processing and dissemination. They will be the final arbiters of data quality issues and will be responsible for the veracity and content of all data and information disseminated by and for the Ministry of Agriculture.

They will provide administrative and computing support to the Market News and Information System as well as to the Crop Forecasting System. These two systems will operate autonomously as entities adscribed to the Information Systems Directorate. All official estimates will be issued under responsibility and authority of the Information Systems Directorate.

The Information Systems Directorate must also be

administratively independent of any higher authority that is directly responsible for program execution and service delivery within the ministry.

The functions of this center would be to:

- (1) serve as the liason between all institutions (both public and private) and the Ministry of Agriculture for collection, analysis and dissemination of all agricultural information;
- (2) consult with INEC sampling specialists in the design of sample surveys to be undertaken by MAG and/or INEC;
- (3) consult with INEC data collection personnel in the data gathering activities for surveys to be undertaken by MAG and/or INEC;
- (4) assist MAG and INEC personnel in the appropriate analysis of the data;
- (5) compile all information linked to the agriculture sector from departments within MAG and other private and public institutions (e.g. INEC, CONADE, Central Bank, etc.);
- (6) prepare periodic (monthly, quarterly, annual) publications for dissemination to the appropriate public and private institutions, as well as internal dissemination in MAG;
- (7) review all publications of agricultural information which are published by other institutions prior to the release of the publications; and,
- (8) participate in a formal data users committee with representation from major users (from the private and

public sector) which will provide feedback to MAG and INEC on analysis results and future data needs.

(9) Be the authority for issuing all official estimates.

The National Institute of Statistics and Census (INEC) should be used as a sample design and data collection agency for the Ministry of Agriculture. The experience acquired through the SEAN project in these two areas should not be foregone. INEC has the technical capacity to assist in all sample design (both area frame and list frame approaches), data collection in the field and data processing of all information. The sampling design specialists at INEC should design all data to be collected by MAG in collaboration with the personnel in the Information Directorate in MAG and the personnel in the appropriate department within MAG. For example, if data is to be collected for the national rice program, an information representative from the rice program and a statistical information consultant in the Information Directorate at MAG will collaborate with INEC to design the sample and questionnaires. Similarly, the specialists in data gathering activities at INEC will be assisted by the MAG representatives in collecting the data in the field; MAG personnel would serve an "auditing" function for INEC data collectors. These collaborative efforts at the initial stages of a survey will assure the high quality of the data both from the scientific survey viewpoint and the viewpoint of the agricultural data user.

The essence of the recommendations center on exploiting the potential at INEC and on developing a statistically based

capability to use and disseminate information at MAG. MAG as a user and disseminator of information needs to evolve into an effective demander of quality data. INEC has the statistical (theoretical and operational) foundation for developing and supplying data of high quality on a timely basis. To achieve the potential at both institutions it will be necessary to provide continuing technical assistance in a learning-by-doing type of training scheme and to provide financial resources for upgrading the capability to process, exchange, communicate, analyze and disseminate data at both institutions. Conceptually MAG is to institute a distributed data system and INEC will be enhanced in its role as a data gathering and archival facility which is based on strong foundations of statistical theory and methods.

4.1.1. Upgrading of INEC as a Data Supplier

As was stated earlier, INEC has a high unrealized potential which has been revealed and enhanced through its efforts on the SEAN, particularly the development of the Area Sample Frame approach. With modifications to this approach and strengthening of its capacity to process data, INEC can become the effective hub of an Agricultural Information System on which private and public users can place confidence.

The specific recommendations for INEC are directed at establishing it as an effective gatherer and supplier of data of high statistical quality:

- 1) Modify the Area Sample Frame approach so that it develops reliable and timely data on a priority basis for selected commodities, especially rice, hard corn, potatoes, beef,

dairy products and other food and feed grains. These commodity surveys need to be undertaken with sufficient frequency to provide the basis for extrapolating the crop forecasting data to estimates of national production. These surveys should also develop reliable disaggregated estimates of costs of production, technologies used and farmgate prices received for use in developing and monitoring the effects of extent and proposed policies. The Modified Area Sample Frame approach should also serve as the statistical basis for undertaking surveys on issues of special relevance, that may arise from time to time. Examples of these may be studies of the structure, conduct and performance of the dairy and meat production subsectors.

2) Establish the INEC as a central data base for all data, particularly those based on formal sampling procedures or censuses, that may be of any relevance to the agricultural sector. The data base would, of course, include the SEAN data as modified to reflect priority commodities and any other MAG related sample survey data as well as time series and similar data bases developed for and by the Central Bank, the Development Bank and other ministries such as Finance, Commerce and Industry, Health, The National Council for Development, etc.

3) Upgrade the hardware and software capability at INEC so that it can provide integrated and easy access to its data base. The Statistical Analysis System is the ideal software product for this activity and INEC staff already have some capability in its use. The physical equipment (hardware) needs to be significantly upgraded so that it can provide multiple users timely and

complete access to an enhanced data base capability through SAS. Specifically this will require a faster Central Processing Unit, with more actual (rather than virtual) core capacity, much more and faster disk storage capacity for working storage and data base maintenance. The hardware needs to be upgraded for faster and more complete data presentation, as a minimum this should include a high resolution color graphic terminal and a very high speed and high quality printer. To facilitate MAG's access to the INEC data bases, the operating system should be upgraded so that it can support multiple types of remote users through modern high speed data communications devices. As a minimum this should include a HASP compatible remote entry services facility. HASP compatibility and TSO compatibility is required to enable IBM/PC compatible devices at MAG to access the data bases at INEC in time sharing and remote jobs entry modes.

4) Enhance the existing capacity for data management at INEC through a series of short courses related to the use of SAS as a complete data management tool and as an aid for computer facilities management improvement. All of the foregoing recommendations imply the need to enhance the operations management capability of the INEC data center.

With these additional resources and enhancements, INEC should be responsible for all sampling frames and designs for all survey based data. Furthermore, these frames and designs should serve as the basis for expanding all other field data into regional and national aggregates of known statistical properties.

4.1.2. Develop MAG as a Decentralized Data User

A distributed data system should be developed at MAG. MAG should access the INEC data bases through some data communications facility that supports SAS. Working files should be created for use by the various MAG divisions and departments at their own micro-computer facilities. Each of these micro-computer facilities should have the capability of accessing the INEC computer in either a time sharing or a Remote Job Entry Mode. All data and information processing activities, particularly training and design should be coordinated through the central directorate for information. This central directorate for information should be a broker for data and information technologies and services and not a direct service provider. Each data user should be as close to his/her data as possible. The Information Directorate should endeavor to promote modern and rigorous approaches to information systems. The "clout" of the directorate should come from its role in allocating training, hardware and computing resources.

Under a distributed data systems concept, as proposed, each major data user, information processor and disseminator at MAG would be responsible for maintaining the data systems for its function. It would rely, principally but not exclusively, on INEC for data sources, on the information directorate for statistical consultation and access to additional processing and technical assistance resources and on its own data/information systems specialist(s) for processing and analysis.

Each major user of data and information at MAG would designate one or more persons as the divisional and/or

departmental information systems specialist(s). These persons would learn to access and process all data relevant to their divisional/departmental (technical) functions. To achieve this, all information specialists would undergo training on a "short course cum learn by doing" basis that would be coordinated and implemented by the Information Directorate. Training would be a continuous activity and all specialists would have access to highly qualified consultants from INEC, the MAG information systems directorate or from private sector experts, as the specific case should require. The basic idea is to evolve a data users' capability that centers on the relevance to the activities of the specific program, division, office or department and not to create or perpetuate the collection and storage of irrelevant and mostly invalid data.

The Department or Divisional Information Specialist (DIS) will generally be an agronomist, animal scientist or an economist; the profession is dependent on the functions of the particular unit to which he is assigned. This person is currently a person with technical skills in his/her field working in MAG. Initially, technical assistance will be necessary to train these professionals in the use and analyses of data. Continuous on the job training will continue for a period of time. This training and assistance will be provided by the statistician and data analyst in the information center in MAG with the assistance of US technical experts with on-the-job and learning by doing experience. Both the statistician and the information specialist (DIS) will consult with INEC regarding

sample design and data gathering activities. This information specialist will coordinate data gathering and analysis activities relevant to his department, he will receive assistance from the statistician specialist at MAG and the personnel at INEC. The first few years of the project will require in-the-job training in statistics, economics and data analysis for these information specialists (DIS). The specialists should meet regularly (monthly) with each other and the personnel of the statistical center in order to learn from the experience of the information specialists. Short courses should be undertaken with all information specialists together for each course.

4.2. The Crop Forecasting System

The crop forecasting activity would be an independent activity operating under the coordination of the Directorate for Information. The sampling frames for crop forecasting for individual crops would be developed from the Area Sample Frame at INEC, perhaps with oversampling to represent particular cropping systems in specific regions. Data would be collected by MAG personnel assigned to the crop reporting activity and located in the principal producing regions. These personnel would be recruited from the regional and commodity programs and trained in the relevant crop reporting techniques. They would coordinate with local MAG personnel, but not be under their chain of command. They would therefore need to be provided with their own vehicles, logistics and communications support and travel expenses.

Initially the system would begin with rice, potatoes and

beef and dairy products. For the crops they would report by region and production technology on areas to be planted, areas planted, crop growing conditions, areas harvested and actual yields. The methods for forecasting would be developed in collaboration with the PRONAREG and INAMHI activities in this area. INEC would perform the expansion to total production or at least supervise the statistical methods used in the production forecast.

For livestock the reporters would report herd populations, reproduction, mortality, extraction rates, selling and culling ages, estimates of sizes of animals sold on the hoof (large, medium, small) conditions of pastures, use of supplemental feeds, milk production per cow and slaughter of reproductive age females. INEC would develop the sampling scheme for these reports and compute the estimates of current and future milk and meat production in collaboration with MAG's cattle program personnel.

4.3. Market News Information

Market News Information would also be a separate unit under the Information Directorate and not assigned to the marketing sub-secretariat or any other unit responsible for price stabilization activities. This Market News and Information System would be guided by a private sector users board appointed by the minister. The board would consist of two producers of each commodity being reported, two intermediaries, a senior MAG executive and the Director of Information Systems. He should design and implement a comprehensive training program to develop

individual commodity reporters operational skills needed to successfully implement the program. This should provide a nucleus for future expansion.

The Market News Division would be responsible to the Directorate for Information. The basic market news requirements would be provided by the advisory/evaluation board appointed by the Minister of Agriculture. The Division will be responsible for the training and selection of the commodity branch reporters. They will be responsible for the structure of the individual commodity branch programs, the design and content of the reports issued and the time schedule for obtaining and disseminating the desired data. To accomplish this technical assistance for a period of at least one year will be required.

The listed requirements are based on opinions formed through limited observation of the marketing system. The most relevant level of trading to report is the price that the first intermediary establishes with the first wholesaler or miller-processor at the principal market places for each commodity in the Market News System. The trading prices will be obtained by voluntary response from both trading parties (the buyer and the seller).

It is at this point in the marketing/distribution chain that many commodities flow through a narrow channel in major volumes that will reflect individual price values established within the industry. It is at this level that it appears accurate trading prices and volumes can be easily obtained and confirmed.

The advisory boards should recommend their choice(s) of the type of information for dissemination, i.e. radio, newspaper,

automatic answering devices, strategically posted prices, etc. The reporter will be responsible for the local dissemination and transmission of this report via word processor through telephone line connection to the electronic information exchange system at MAG's Information Directorate. The reporters qualifications should include a basic knowledge of the individual commodity, a comprehensive knowledge of the commodity marketing processes, and a personality compatible with the involved traders. It is doubtful that persons with these skills are available, so the personnel administrative office should design tests to select individuals with the potential skills that can be developed by the proposed training program.

This Divisional office should be equipped with word processing equipment connected by telephone or leased wire to the individual commodity offices, and a switch mode that stores and transmits on predetermined schedules market news to the central data processing system, and selected information from central data processing to the commodity offices, i.e. crop estimates, weather reports and forecasts, and any other information that is relevant to the individual marketing area. The operation and administration of this office is under the supervision of the Market News director, but the switch mode programming and transmission schedules have to be controlled by the central data processing system.

An alternative approach is to contract the market news function to a private sector market research firm operating in Ecuador. The contract would be placed for bid every two or three

years. The MAG staff for this activity would consist of the Division Director and an Aide. The Director would be the executive secretary of the governing boards and with the Aide would perform periodic spot checking in the field to insure contract compliance by the private contractor. The technical assistance would be used to develop very detailed terms of reference for the bid solicitation, to provide technical directions to the contractor observing the first year of operation and to provide consultation to the director of the office and the governing boards.

4.4. Data for Policy Formulation and Evaluation

The process of the distributed data system is perhaps best illustrated by the use of data by the Policy Analysis Unit at the Ministerial Council. Econometricians and other information specialists in this unit would request data from the operating programs--such data would cover cost of production, yields under various technologies, factor cost shares of traded and not traded inputs, etc. Other data might include time series price data, exchange rate data, etc. from the INEC data bases. The policy analysis unit would process such data for a number of economic analysis issues. At the start of the process, the information specialists in the policy analysis unit would consult on their data needs with the information directorate. These latter, in their brokerage function would direct the Policy Analysis Specialists to the appropriate data sources intra and extra MAG. They might also provide some statistical and computing consultation for the contemplated task, if such assistance were

needed. If more assistance or computational processing were needed, than was available within MAG, then external (INEC, private sector or expatriate) technical resources would be contracted through the Information Directorate from a fund, for such purposes, that it would manage.

5.0. Recommendations and Conclusions

The initial assessment of the agricultural information system has led to the following recommendations:

- (1) use INEC as a basic data design and collection agency for much of the agricultural information system;
- (2) upgrade the computer hardware for INEC in terms of memory, discs, printers and graphic terminals; the operating system should be upgraded to provide remote job entry services;
- (3) provide short term technical assistance in Ecuador and the US for INEC in statistical analysis and data management of large data files, including SAS courses in Ecuador; proceeding from BASICS, to Applications to Econometrics;
- 4) provide computer training and computer programmer/SAS expert for support for both MAG and INEC;
- (5) provide micro computer equipment to the MAG for financial reporting, word processing and data analyses. These micro computers should serve the threefold purpose of analysis of small subsets of data as well as links to a larger main frame computer at INEC for analysis of large files collected and maintained at INEC, and word processing of all publications, especially the crop reporting and market news reports. In addition, provide some faster remote job entry terminals to MAG, after training in data analysis is completed;

- (6) simplify questionnaire currently being used by INEC in agricultural survey rounds, to provide basis for crop reporting as well as historical data;
- (7) INEC should run one survey a year that collects special data, i.e. farm production expenditure data, cost of production data for selected crops, farm labor, etc. to fulfill the data needs for policy analyses;
- (8) reduce the samples in the survey from 3300 segments to about 2000 segments; take replications out of the large homogeneous provinces in the Coast. (INEC knows how to do this.)
- (9) set up formal data users committee with representation from major users. This committee will provide feedback to the MAG and INEC on results and uses, it should meet twice a year at the time of publication draft release.

5.1. Technical Assistance Required to Implement an Agricultural Information System

In order to implement an operational and reliable information system, the following are the skills and experience requirements for the long term technical assistance:

1. Senior Agricultural Statistician for MAG
 - a) Survey design and analysis experience
 - b) Econometrics (Time series models)
 - c) Data management of large files with SAS
 - d) Micro computer experience
 - e) Knows Latin American (Andean/tropical) agriculture

f) Spanish teaching (short courses experience)

TERM: 2 years at MAG Information Directorate

2. Market News/Grades & Standards Specialist

a) Market news reporting experience

b) Dissemination of news experience

c) Knowledge of "basis for sale"

d) Spanish a must

e) Agricultural communications background desirable but not mandatory

TERM: 18 months at MAG with short term follow up for the life of the project.

3. Crop Reporting and Forecasting

X) Coordinate closely with senior statistician and operate under the Directorate of Information at MAG.

Short Term Technical Assistance

- | | |
|---|---|
| 1. Area sampling frame specialist expert | Data collection knowledge
Complex survey design expertise
Questionnaire design and Weighted Analysis Experience
Anticipate several new surveys |
| 6 trips/one month each | |
| 2. Computer Center Management for INEC | Special support for director and assistant director at INEC |
| 1 trip to US for two/1 month each
1 trip for expert to Ecuador | |
| 3. Econometrician | Utilize data stored in computer at INEC for MAG. A resource for long term econometrician |
| 5 trips/1 month each | |
| 4. Public relations training | Need to know where and |

how to "catch public eye"
when presenting data
very important function

2 trips/one month each Ecuador
2 trips/one month in US

5. Multiple frame expert

Very specific knowledge
about how to combine
estimates from ASF and
list frames. Should know
problems of data collec-
tion and list maintenance

4 trips/1 month each

6. Sampling short courses for INEC 10 persons one month
Statistics short courses for MAG 10 persons one month
(each year of the project)
(periodic 2 week courses in SAS for INEC and MAG.

7. Short courses for MAG on micro computers including hardware,
BASIC, spreadsheets, RJE and TSO.

8. Information systems and SAS data management designers
implementors for MAG and INEC.

16 to 20 person months over life of the project to assist
specifically designated problems.

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