ERRORS AND LIMITATIONS IN ECONOMIC INDICATORS AND AGRICULTURAL POLICY ANALYSIS

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A new probability survey of the farm sector, the Farm Costs and Returns Survey (FCRS), has been designed and implemented by the Statistical Reporting Service (SRS) and the Economic Research Service (ERS), U.S. Department of Agriculture. The survey was designed to address the recognized need for improved estimates of economic indicators for the farm sector.

The FCRS merged two previous surveys, the Cost of Production Survey (COPS) and the Farm Production Expenditure Survey (FPES). This merger was instituted by both agencies in order to (1) directly obtain data for use in preparing economic indicators and statistics series for which the agencies are responsible; (2) estimate these series with more accuracy and reliability; (3) provide additional farm sector data to answer questions about economic well-being and performance of farms by size, type, location and other distributional aspects, and (4) obtain economies inherent in merging two surveys. To summarize, if agricultural policy decisions depend on reliable and timely information about the well-being and performance of the farm sector and the different types and sizes of farms within it, then the FCRS will affect the quality of estimates and, ultimately, the perception of the particular needs and problems of various farm sector components.

This paper is organized into eight discussion areas: (I) limitations in policy analysis using sector survey data; (II) data implications of policy and program analysis; (III) background for change in the agricultural data system; (IV) the Farm Costs and Returns Survey; (V) SRS and ERS interaction; (VI) FCRS results; (VII) presenting relevant economic indicator and survey information for policy analysis; and (VIII) summary.

I

There is substantial agreement among agricultural economists that the agricultural economic and financial environments have changed substantially since each of the Food and Agriculture Acts of 1973, 1977, and 1981. The passage of each Food and Agriculture Act effectively sets the tone and background for four more years of policy debate--and subsequent policy and program adjustments. Undoubtedly, the economic environment and consequent policy issues for producers and policymakers will again change substantially under the Food and Agriculture Act of 1985. The results of current research efforts during this Farm Bill and afterwards will depend on the data available for use by ERS and other researchers and how useful these data are in addressing the issues raised by the current and future farm financial and economic situations.

Since some policy issues can be anticipated with a degree of certainty, research publications, working papers and other documents must be prepared based on available economic indicators series. These documents generally serve three basic functions during the policy and program formation process:

- o analysis of the impact, consequences, and efficacy of existing law;
- o defining the important policy issues in anticipation of legislative action;
- o providing general background education on issues and alternatives (Infanger, et al.).

Users of agricultural data have become accustomed to a long history of published aggregate agricultural statistics. The Bureau of the Census, through the quinquennial Census of Agriculture, and the Department of Agriculture, through periodic surveys conducted by SRS, have been the main providers of aggregate farm sector data. These include data on the number of farms, their characteristics, land use, commodity production, product disposition and value, inventories, resource use, prices paid and received and labor hours and wages. From these primary data, government agencies, and particularly ERS, generate statistical and economic indicators. In terms of the economic indicator and statistics series generated by ERS, data users are most likely familiar with estimates of farm income, farm assets and liabilities, costs of production, and agricultural productivity.

However, even though a variety of primary and secondary data series are available for economic analysis, the agricultural data base remains far from complete or flexible enough to be fully effective in responding to current policy or disciplinary research needs. Since the American Agricultural Economic Association's Committee on Economic Statistics authored a seminal review on agriculture's obsolete data systems over a decade ago, little attention has been given to what the committee called, "our ... investment in the conceptualization of agricultural data systems and to develop the entirely new systems of data needed to contend with problems of a rapidly changing economy and way of life" (AAEA).

There is almost a universal understanding by agriculturalists that the technical, financial, and managerial organization of farming has changed dramatically in recent years and will continue to change. Yet, the agricultural data base has remained wed to a concept of a homogenous farming sector and to the farm rather than the farm/household as the basic unit of observation (Schertz). Consequently, given the heterogeneity of today's farm sector, conclusions about farm well-being by type and size of farm and other distributional issues are suspect when they're drawn from aggregate statistics. Of course, many researchers and policymakers have commented on this information gap, and the FCRS is a major step in developing a flexible farm sector farm/household data base to address these limitations.

II

We define policy analysis as the rules for playing the economic game and programs are the means or procedures used to execute policy. A policy decision might involve whether or not to stabilize commodity prices, and if so, whether to stabilize producer or market prices. A question of this sort would imply certain data needs such as potential budget and exchange rate reactions or historical information on program participation. Program analysis involves information and research that estimates and evaluates the various effects of a change in specified variables to test the feasibility, cost, benefits, and secondary effects of a proposed policy and its implementation. For example, if we wanted to stabilize prices, we would need data to predict the behavior of farms and their degree of (non)participation in various programs, and if feasible, choose the most efficient program to implement policy. This type of research demands data that would be a subset or input into the general policy analysis that led to the investigation of program effects. The distinction we have drawn here is somewhat artificial because policy and program analysis are often simultaneous but is useful in pointing out the different data needs of policy makers and their demand for economic research.

Another reason for differing data needs by policy makers and other users is the level of aggregation of the problem being studied. Obviously, if the analysis is from a sector viewpoint, the variables of interest to the policy decisionmaker and the data needed will differ from the viewpoint of an individual farmer or industry, such as wheat or dairy. As an example, from the viewpoint of the farm operator, the policy and economic environment are exogenous factors and are often treated as unalterable by any operator's actions (see figure 1). A farm operator or producer views the agricultural system from the center of figure 1, and as an actor. Given this exogenous environment the farmer tries to maximize income and farm well-being by allocating inputs or resources among crop, livestock and off-farm (income producing) activities. As Baum and Harrington have suggested, the producer has two related problems given an externally defined policy and economic environment:

- What is the optimal production and marketing behavior?
- What is the optimal production and marketing behavior (in the short-run and long-run) if the policy environment changes?

For the policy maker or the analyst, the decision perspective is different because the problems are posed from a different perspective than that of the producer. "What is the producer (industry) likely to do? This problem suggests an alternative viewpoint from evaluating the behavior of the agricultural system from the left hand side of figure 1. From this viewpoint, a system perspective is called for, because the policy/decision maker or analyst is, by nature, trying to manage more than one actor's behavior.

It should not be surprising that policy analysis is from an aggregate or macro viewpoint and the policy questions and hypotheses being tested usually revolve around how the agricultural sector or set of subsectors would or will likely act or react. Thus, a policymaker's information needs would be expected to differ from that of an economist working for an agribusiness concern or a producer association because the latter professional would be concerned with farm-level or industry adjustments.

The discussion point to be emphasized is that there is significant and qualitative difference between (1) information developed from a micro or disaggregated perspective emphasizing individual optimizing behavior and (2) information developed from the likely behavior of an agricultural system made up of an interacting set of producers and consumers. As a consequence, policy (or program) analysis from a farm level, disaggregated viewpoint, if data is available, is likely to provide a different type of useable knowledge about alternative policies for decisionmakers, because information will be provided about the behavior of the individual parts of agricultural sector rather than the system as a whole.

III

The quality and use of agricultural data for policy analysis embraces both conceptual development and empirical measurement. The research community both within and outside the USDA have focused considerable attention for many decades on the quality and potential analytical usefulness of a national agricultural data system to support policy, production, finance, and farm management research.

Conceptual Development. The AAEA Committee on Economic Statistics concluded in 1972, "that the data systems upon which we depend are in serious trouble". The Committee stated that with continued structural transformations in agriculture and rural life, "theoretical concepts around which we have constructed our data systems grow progressively more obsolete--so obsolete that minor tinkering with each census or survey no longer seems to bridge the basic inadequacy of the ideas being quantified" (AAEA). The Committee developed an ambitious agenda of topics focused on reducing data collection obsolescence. As Lee noted, however, the Committee did not go beyond a listing of issues that established "the dimensions of social data needs,--noting further that while the committee identified problems--"with the data system".. they told... " us little about what to do about them" and what survey (systems) should be undertaken.

Bonnen, in his 1975 address, moved the profession beyond a listing of data base needs, providing insight into conceptual obsolesence in data and developing a paradigm for an agricultural information system (figure 2), based on an integrated amd unified economic survey such as the FCRS. Bonnen suggested first that every data system involves an attempt to measure reality. Theoretical concepts are developed to portray a

complex "reality" in a way that can be understood --yielding answers to the question of what is to be measured. Data are then collected to realize the concepts, resulting in measurement and data output--a data system. Subsequent movements to higher order information then requires interpretation and analysis, which is ultimately the information system used by decisionmakers--the source of demand for data.

During the 1960's and 70's analysts in the USDA were also studying these same data system issues both conceptually and statistically through a redesign of sampling frames for crop and livestock surveys. Trelogan stated that, "The cornerstone for a new farm statistical structure in the United States was laid in 1966 when the Statistical Reporting Service of the USDA put a probability sampling scheme into operation in the 48 contiguous States." Beginning in 1970, list sampling frames were used to supplement area sampling frames. This enhanced the probability survey design by introducing the multiframe sampling procedure for USDA surveys. In 1972, the multiframe survey approach was extended to surveys used to collect economic data. The development of new technical means to conduct surveys was crucial to the FCRS because the FPES is an extensive multiframe survey.

The quality and usefulness of agricultural data embraces both the conceptual development of data series as well as the empirical measurement of economic variables, such as the economic indicator series. Over the last two years, ERS has reviewed each component of the published income, cost, balance sheet, and productivity accounts for their conceptual consistency and empirical procedures using the goals in figure 2. We realized that we needed new information that had not yet been obtained as primary data.

During the same period we also reviewed the primary sector surveys conducted by SRS and ERS that supported our farm accounting systems. As a result, revisions to the survey questionnaire, sampling methodology, and survey size were suggested that would yield more data on farm producers by type, size, and location of production units. Also, the type and amount of financial data, such as farm income and assets, was substantially increased. Finally, we decided to break with tradition and structure the questionnaire in order to reflect overlapping data needs. The result of much work in these areas was the FCRS, which is not just a technical innovation but represents a review and reformulation of our entire economic indicators and statistics program.

IV

In recent years SRS and ERS conducted two national surveys: the Farm Production Expenditures Survey (FPES) and the Cost of Production Survey (COPS). The FPES was a probability based whole farm survey used to collect total farm expenses and receipts data for preparing national economic indicator and performance measure series. The COPS was a non-probability survey and only collected enterprise-specific technical data on farms known to produce the selected commodities. Since COP operators were selected to provide data for an average acre, or livestock enterprise, these farms were selected on a probability proportional to the acreage or size (PPS) of the selected enterprise. Thus, the type and size of farm statistics could only be obtained for the respondent farms and not for the farm sector because survey expansion factors were unavailable.

Although similar types of information were gathered from both surveys, the COPS data could not be used to supplement the FPES and the FPES could not be used to highlight COPS data because of the difference in sampling methods. Thus, much information was irrelevant from the perspective of either survey. From a distributional analysis perspective, two problems remained to be addressed. First, the entire sample size was too small; second, only a portion of the total survey data collected was useful for reliable type and size of farm analysis.

The process of impementing the FCRS started in the 1982 and 1983 calendar years, when the FPES was redesigned to provide farm operator occupation, production, Government program participation, aggregate asset and debt, and expanded crop and livestock sales data. These data were used to develop preliminary estimates of farmers' cash operating balances and debt positions based on specifications of size, farm type, and region. During the last several years, ERS and SRS worked jointly towards merging COPS into FPES to produce a probability based Farm Cost and Returns Survey.

The Farm Costs and Returns Survey is an integrated whole farm and commodity specific survey that allows subsampling for specific enterprise cost of production information (figure 3). The survey design also allows new economic modules to be inserted into the survey questionnaire, if the need for special survey work arises. The FCRS is expected to be given a continued annual funding for 25,000 to 30,000 list and area frame contacts annually. Given the expected large number of questionnaires, distributional and regional analysis of operating costs, returns, and financial characteristics can be conducted.

To implement the FCRS, five questionnaires were developed to obtain 1984 data. The first version of the 1984 FCRS was a detailed expenditure questionnaire that was similar, except for enhancements to expand household and business financial information, to the 1983 FPES. This version, except for several aggregate questions, did not obtain any technical data necessary for developing enterprise cost estimates. Cost of production was needed for four commodities in 1984: rice, sugarbeets, forage and burley tobacco and the remaining four questionnaire versions were for each COP commodity. These COP questionnaires were divided into two sections. The first section obtained the same financial, expense and other data asked for in the detailed expenditure version of the FCRS. The major distinction was that, in most cases, expense data were asked for through aggregate questions. This allowed researchers to use all the FCRS questionnaires to examine certain expenditure or income items. For impor-

tant areas such as acreage and income, questions were identical between the FCRS expenditure version and the first section of FCRS-COP; thus no detail was lost in areas important to ERS or SRS. The expenditure section of FCRS-COP was then followed by a technical practice section (module) with questions needed to develop the COP budgets.

An immediate improvement is that COP data are now on a probability basis. A more general benefit is that COP and other distributional analyses are now more feasible. The data set can be examined by size and type of farm and region from an enterprise, farm, industry, or sector perspective. Earlier comments by Prescott and Baum on the FPES also apply to the new FCRS: The survey data are important for three reasons. First, to reiterate, it is the only national source of establishment data comprehensive enough to analyze farm expenses, returns, and financial data, by region, size, and type of farm. Second, the data are obtained through a probability sample where each farm operation is selected with a known probability and expansion factor. A probability sample is necessary if statistical properties of the data are to be estimated. Third, the survey can be correlated with current events or used to formulate specific economic indicators and performance measures for policy research and analysis.

V

With respect to FCRS design and implementation figure 4 shows the steps involved in the FCRS project and which agency has primary responsibility at each step. As primary end user of the FCRS, ERS has a major primary responsibility for determining what information is needed. However, this responsibility is constrained by SRS needs for certain standard expense items that are used in various SRS statistical series. As survey design continues, SRS and ERS rotate primary responsibility. It is the responsibility of ERS at this stage to direct and aid SRS to help obtain data in an efficient manner. It is the responsibility of SRS at this stage to implement a workable, efficient survey and direct ERS in designing data systems that are realizable, non-redundant and accurate.

Interaction between ERS and SRS continues during the implementation stage, and in this aspect may be unique. ERS personnel attend the national training schools for SRS state statisticians running the survey. Partly as a consequence, ERS economists learn something here about survey design in general. Also at the schools, SRS personnel are made aware of the uniqueness and importance of this survey to ERS. Both agencies discover problems and solutions to FCRS related questions during the schools. This detailed knowledge is essential when we turn to analyze the final survey product. During the implementation of the survey at the state level, ERS economists have helped conduct the state training schools for SRS field enumerators and have participated in the state office edit of the questionnaires. These activities usually occur in those states where the number of contacts and enumerators are large or when particular assistance is requested. This process of mutual acculteration between statisticians and economists should have a positive effect in future years on survey modification.

At the last stage, ERS has crucial input during the final stages of the data edit. ERS's and SRS initial data analysis for our various reports serves as a final step in the data edit. If systematic problems in various questions are found or if loopholes in the flow of the questionnaire are discovered, they can sometimes be remedied even at this late stage by contacting and working with the state offices. The FCRS was summarized this year using SAS (Statistical Analysis System) to facilitate the last stage of data editing.

We would like to note that economists who obtain data from surveys frequently design and lobby for questions that are ill-considered and badly designed. This can thwart the economists' objectives. Economists do not have a comparative advantage and should not be responsible for the final design of questionnaires, and should discuss and explain their data needs and specifications with statisicians responsible for data collection and field personnel involved. Moreover, economists who work with primary data must make an effort to understand sampling and actual field procedures. This includes interviewing the "unit of observation", the farmer. Experience with actual survey technology and practice is necessary if ERS and SRS staff are to work effectively together to institutionalize the FCRS and enhance it over time.

VI

The effectiveness of the FCRS's coverage of the farm sector is illustrated by comparing the distribution of farms by production speciality to similar data from the 1982 Census of Agriculture (table 1). Nationally, farms specializing in either crop or livestock accounted for about half of total farms. Cash grain was the most common crop farm type and general livestock the most common livestock farm. As table 1 indicates, the distribution of farm types are similar for the FCRS and the 1982 Census of Agriculture; the differences are hypothesized to be due to sampling error and changes in the distribution of farm types between 1982 and 1984.

The 1984 FCRS generally provided close expanded level of harvested acreage of principal crops in comparison to those developed by the Crop Reporting Board of USDA. When the acreages were adjusted for differences in coverage, the total of the principal crop acreages differ by only 3.2 percent.

The 1983 FPES had 22,361 contacts and yielded 11,640 completed questionnaires. The 1984 FCRS had 23,041 contacts and 13,988 completed questionnaires. The refusal rate dropped by 3.8 percentage points between the two surveys and the inaccesibile and incomplete rate fell from 9.3 to 7.2 percent of the total. Thus, even though we fielded a new, more complex survey, key perform-

ance indicators improved.

The increased number of contacts and the increased training effort also yielded lower coefficients of variation from the sample (table 2). Using all FCRS versions to estimate U.S. production expenses provided a marginal improvement of 1 percent, but for interest expense, an important item in the current economic situation, we obtained a dramatic reduction in the relative error.

In 1984, aggregate production expenses were about $140 billion. A coefficient of variation of 1.7 implys that the chances are 19 out of 20 that production expenses would be between about 96 to 104 percent of $140 billion. This implies a possible variation in farm income of plus of minus $5.5 billion. Since the 1984 estimate of net farm income is about $35 billion, this estimation error illustrates the importance of increased precision in the FCRS survey.

VII

The final step in the chain of collecting and using survey data is presenting relevant economic indicator or survey information for the policy and program decision making process. Whoever the information delivery agent may be, (sometimes an agricultural economist), they must be prepared to present relevant economic indicator or survey information immediately or quickly. If this is to occur, the relevant issues for the involved researcher and policy analyst are:

- o Who will need the information?
- o What decisions must the policymakers make?
- o What information is necessary to these decisions and when must it be provided?
- o How can the information be developed?

Obviously, to be useful within the policy process, we must recognize the need for and develop information that is relevant to the fundamental types of policy decisions discussed earlier. It is also important to note that that policymakers must make decisions whether or not they have complete or perfect information and that the policy decision process will reward those who provide needed information. It should also be remembered that those who supply useless or redundant information, or provide excellent information only after the decision has been made, will likely find it increasingly difficult to participate in the next policy decision.

Our intention is to emphasize that disciplinary or technical research will not become part of the policy decision making process, unless it is related to other important decisions and criteria used by policymakers. As Gardner has cogently suggested, perhaps partly from his experience on the Council of Economic Advisors:

> "I think there is a real problem in that investigators in agricultural economics generally, while they devote some effort to collecting data appropriate to an issue, and a great deal of effort to using econometric techniques to wring a story out of the data, spend practically no effort in drawing policy conclusions. This task requires putting the results in a broader context and considering alternatives to the conditions investigated, and taking into account the institutions by which policy is generated. Instead, policy results are usually stated in a short section towards the end, with a level of sustaining argument nowhere near what has appeared in the "scientific" part of the paper. The form of the argument is typically: I found such-and-such to be a problem, it ought to be corrected."

Finally, It is not enough for the analyst to conclude that the information presented will be useful for a part of the policy decision process. The analyst must actually show how it is useful, how other variables in the system will or will not be affected, the probability of such consequences occuring and the policy and program alternatives available to the policy decision maker. Finally, it is our experience that this information must ultimately be distilled down to a page or two highly focused decision memorandum to increase the likelihood of its actually being used.

VIII

Aggregate agricultural statistics and indicators of the farm sector have long served as measures of economic well-being and as input in the policy process. But, economic indicators must increasingly be trustworthy and also disaggregated to be useful for policy and program analysis. Consequently, surveys used to build the data set must be implemented on a probability basis, and designed to collect data relevant to the various economic indicators and other information needed by decisionmakers, while maintaining conceptual clarity, flexibility, and progressive adaptablity for future information requirements.

The Economic Research Service and Statistical Reporting Service have made and will continue to make needed revisions to USDA surveys, data bases, conceptual methodology, amd empirical procedures in order to monitor a modern, changing, and heterogenous farm sector. Recently, for example, two surveys have been integrated into a combined Farm Cost and Returns Survey to collect data to support the aggregate accounts, national cost of production estimates, and a range of disaggregated indicator data by type and size of farm. The FCRS will establish a national, annual and whole farm data set while avoiding the collection of incomplete and incompatible data.

Finally, our comparative advantage as empirical scientists providing information for policy decisions while also participating in policy analysis is that, as economists and statisticians, we are trained to spend much of our time trying to understand how the world works. The reliability of our advice depends on the accuracy of our knowledge and insights about why farmers and the farm sector behave the way we observe them to behave.

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Table 1. Distribution of Farms by Type of Farm

Farm Type	1984 FCRS	1982 Census of Agriculture
	Percent of farms	
Crop	50.6	46.1
Cash grain	23.6	25.7
Field crop	8.9	11.3
Vegetable	1.5	1.4
Fruit	2.6	3.8
Nurseries	1.6	1.6
Livestock	49.4	53.9
General livestock	34.9	40.4
Dairy	10.6	7.3
Poultry	1.9	1.9

Table 2. Coefficients of Variation for Selected Items from the 1984 FCRS and the 1983 FPES

	FCRS-All versions	FCRS-Expenditure version only	1983 FPES
U.S. Feed expense	3.5	4.1	3.8
U.S. Interest expense	2.0	2.5	2.9
U.S. Total production expenses	1.7	2.0	1.8

Figure 1

Schematic Representation of Some Determinants of the Farming System (Gilbert, et al.)

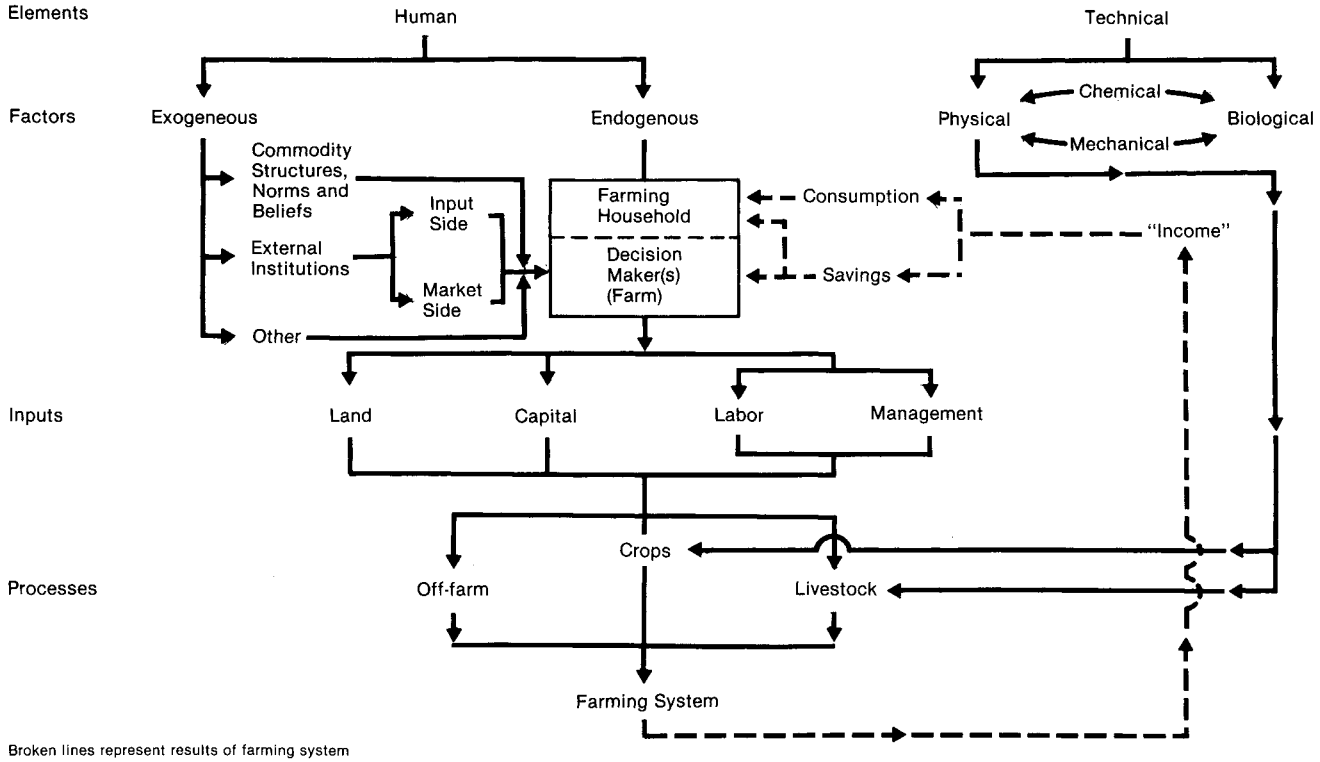

Figure 2

An Agricultural Information System

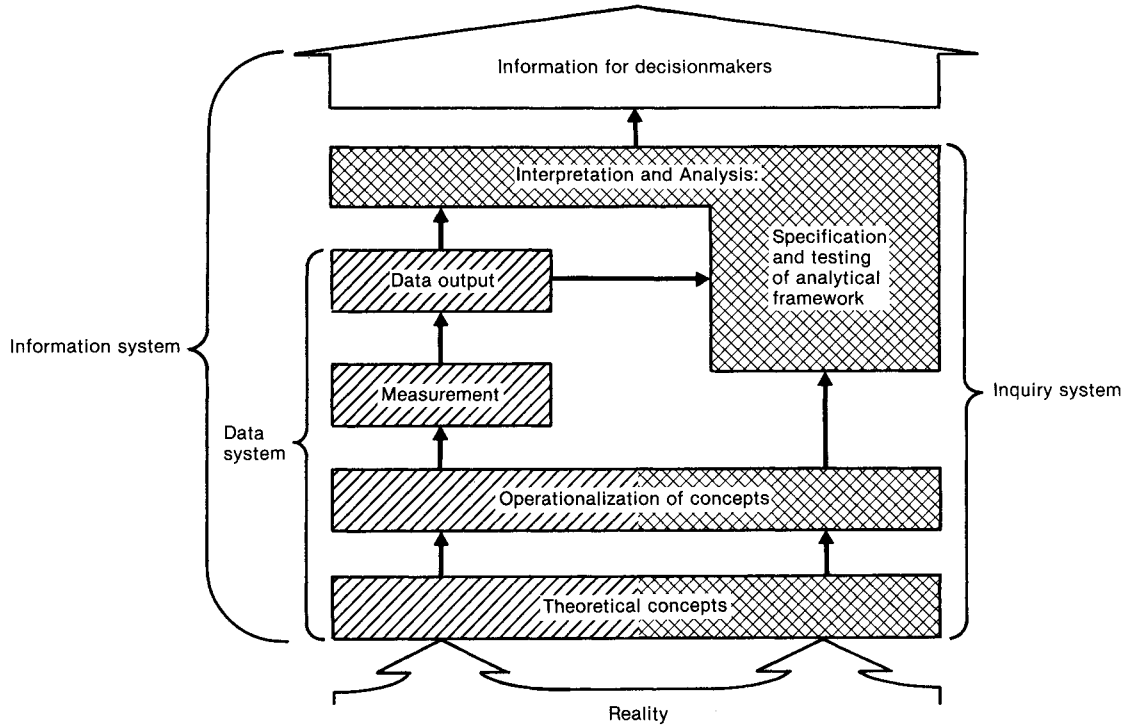

Figure 3. The Farm Costs and Returns Survey: FY '85

Detailed Expenditure and Receipts Version	Detailed Enterprise Technical Practices Versions
Farm Cost and Returns Survey (24,000 contacts)	
Part II--Farm Operating & Screening Characteristics	Part I-- Farm Operating & Screening Characteristics
Part IIA--Detailed Production Expense Data	Part IIC--Aggregate Expense, Finance & Receipts Data
Part IIB--Detailed Receipts and Finance Data (13,500 contacts)	Part IIIB--Enterprise Techinical Practices Data (10,500 contacts)

Part I. Screening and general farm operating characteristics--
Land use; Crop acreages & yields, etc.; Farm business and financial organization

Part II (A,B,C). Farm production expenditure, receipts and financial data including items such as--
Whole farm expenses by type or category; Livestock inventory, sales, purchases; Crop receipts, inventory, etc.; The Farm Business Balance Sheet

Part III. Modular sections for specific detail to be used for--

A. Detailed information needs for special and key variables and data items relating to production activities and whole farm expenses.

B. Data on particular types or categories of farm organizational characteristics and technical practices used in crop and livestock production.

Figure 4 Survey Design and Implementation