October 1991

91-17

Working Papers in
Agricultural
Economics

Rural Household Data Collection in Developing Countries:

Designing Instruments and Methods for Collecting Farm Production Data

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CORNELL FOOD AND NUTRITION POLICY PROGRAM

RURAL HOUSEHOLD DATA COLLECTION IN DEVELOPING COUNTRIES: DESIGNING INSTRUMENTS AND METHODS FOR COLLECTING FARM PRODUCTION DATA

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This paper was made possible by the cooperative efforts of Per Pinstrup-Andersen, Director of the Cornell Food and Nutrition Policy Program (CFNPP), and William Tomek, Chairman of the Department of Agricultural Economics, Cornell University. The author would like to thank both for financing the editing, production, and printing of this working paper.

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ABSTRACT

This paper aids researchers who are conducting microeconomic work in developing countries to more effectively collect farm production data. The discussion focuses on helping the researcher who has fairly well-defined research ideas to better visualize the steps that are necessary for collecting farm production data by raising conceptual and organizational issues that will be faced during the collection process. A wide range of data collection strategies is reviewed for both data-intensive studies that concentrate on production and technological issues, as well as less intensive studies that are only interested in measuring the contribution of farming activities to overall household income. Both survey-based and recordkeeping methodologies are discussed and the tradeoffs of each approach are considered. Examples of survey and recordkeeping instruments provide illustrations of both successful and not so successful forms; the merits and weaknesses of the sample forms and associated data collection methods are critiqued.

FOREWORD

This paper is one in a series of seven working papers on collecting rural household data in developing countries. Between late 1986 and early 1988, six Ph.D. candidates from Cornell's Department of Agricultural Economics left to do the fieldwork in developing countries for their dissertations. Upon returning to Cornell in 1989, they discovered that they shared common experiences and frustrations while collecting household-level data for analyzing applied economic problems in developing countries. This series of working papers is the result of their collective effort to help other researchers avoid common pitfalls and build upon their experiences.

The working papers provide a practical field guide – for use together or separately – for individuals collecting a wide range of household information in developing countries. Each paper introduces the conceptual and practical difficulties involved in making different types of measurements or collecting different types of information. The guide is intended to provide readers with enough information about various methods so that those best suited to an individual's needs can be selected. Therefore, a variety of methods for collecting data are reviewed and the consequences of choosing one method or another are discussed.

Each working paper is organized into a section on conceptual issues, followed by a section on methods and organization. Conceptual issues address problems that researchers encounter when they move from a discipline's theory to empirical investigation. Often these include defining or measuring dynamic concepts or institutions such as the household, farm unit, time, or the valuation of goods. Related to this is evaluating whether or not to use certain variables in measuring rural lifestyles. In attempting to quantify particular aspects of rural economies, researchers realize that their definitions of selected variables do not always suit the reality of village economies. Thus, the sections on conceptual issues address the need to reconcile the researcher's theory and preconceived ideals with the realities of the survey site.

Although the related literature is reviewed in each working paper, the primary source of information has been the collective research experience of the authors. Examples of field experiences illustrate points made in each working paper. Many items that the authors felt they would have benefited from are included as well.

The target audiences are graduate students and other researchers, academicians, consultants, government employees, members of private voluntary organizations, etc., who are interested in collecting high quality socioeconomic, nutrition, and health data related to rural households in developing countries. In particular, the guide is for individuals who may not have had much prior experience in collecting this type of data, who may not have access to other current written material on data collection methods, or who may have some experience, but may not be aware of recent developments in data collection methodology.

One unique aspect of the series of working papers is its attempt to provide many examples of survey forms that have actually been used in field projects. Each working paper is built around the following question: How can survey forms and record keeping instruments be designed to assist the researcher in collecting high quality, nondistorted, less systematically error-filled data? Frequently, two or more forms that were used in different surveys (or in different rounds of the same survey) are discussed. The author has tried to be frank and honest, frequently providing criticisms of forms or tables that they used, but with which they failed to achieve the intended results.

Finally, a brief word on the use of 'he' and 'she' throughout the collection of working papers. Since the group of authors was equally divided into three men and three women, as a convention, generic third person pronouns and possessives (he, she, him, her) were consistent with the author's gender and should not be interpreted as a violation of political correctness.

The working paper series includes:

Paper Subject	**Series Number**	**Author**	**Author's Country of Study***
Collecting General Household Information Data	91-13	Krishna P. Belbase	Nepal
Collecting Consumption and Expenditure Data	91-14	Carol Levin	Indonesia
Collecting Health and Nutrition Data	91-15	Jan Low	Northern Malawi
Collecting Time Allocation Data	91-16	Julie P. Leones	Philippines
Collecting Farm Production Data	91-17	Scott Rozelle	China
Collecting Off-Farm Income Data	91-18	Leones & Rozelle	Philippines, China
Preparing the Data for Analysis	91-19	Tom Randolph	Southern Malawi

* Each paper includes examples from other studies along with those from the author's country of study.

October 1991

Carol Levin and Scott Rozelle
Series Coordinators

1. INTRODUCTION

Rural economies worldwide have radically different structural forms. From the intensive rice economies of East and Southeast Asia, to the nomadic tribes of eastern Africa, from the immense *latifundis* (plantations) of Central and South America, to the meager plots of South Asia, each of the world's agriculture-based economies is unique. These forms arise from historical, agroclimatic, populational, cultural, and even geopolitical influences. Although this wide mix of history and culture has made each economy distinct from any other, the agricultural household remains the fundamental economic unit in rural areas.

A crucial step in learning about rural household behavior is understanding its farming enterprises. Other important household activities include consumption, off-farm employment, and leisure. However, because of the importance of agriculture in income generation and employment, and given the high proportion of household wealth residing in agricultural resources, household agricultural production activities – especially practices, output, and income – are a part of almost every study of the rural economy.

THE USES OF PRODUCTION DATA

How are production data used? How do data needs differ given a particular focus of a study? Essentially, two broad categories of research require agricultural data: (1) studies that focus specifically on agricultural production; and (2) studies in which the primary interest is the amount of income that agriculture produces for the household, and/or the amount of labor allocated to agricultural tasks. Studies in the first category are referred to in this working paper series as "agricultural production" studies; those in the second group comprise all other rural studies, including those concerned with consumption, nutrition, or other behavioral or social science issues. Probably the most significant difference in data collecting methods used in these different areas of research is the degree of detail about agricultural production practices and results.

The range of studies focusing directly on agricultural production issues is broad and has a long, rich history of scholarship. Our intent is not to review either the methods or theory of this special subdiscipline. The studies are grouped together because their data requirements are similar.

Social scientists concentrate on three major types of studies of agricultural producers: (1) technical studies; (2) studies dealing with the economic behavior of producers; and (3) studies that focus on special issues, such as income analysis, risk, innovation, and institutional analysis. In reality, few studies belong to a single category. However, most have a major focus within the bounds of one of these categories.

Technical studies of agricultural production are conducted to increase understanding of the agroclimatic environment within which farmers operate. Researchers measure the relationships between inputs and outputs and between inputs themselves. Researchers conduct production function analyses; certain farming systems research; and studies on technical efficiency, scale economies, variability, and agronomy.

Researchers concerned with understanding the economic behavior of agricultural producers are often interested in motivation. For example, why do farmers make particular production decisions? What are the goals of farmers? This family of studies encompasses research to understand both the elements in the environment that allow farmers to realize their goals and those obstacles that keep farmers from accomplishing their objectives. Included are studies concerned with allocative efficiency, constraint measurement, and the assessment and ranking of various goals.

Finally, the last group includes studies more narrowly focused on specialized topics. In general, these examine individual aspects of the agricultural enterprise and/or the farmer's role in these enterprises. This category is virtually boundless, and includes studies that focus on production risk, technology adoption, income determination, and the origin and effect of institutional factors.

Many other study types that focus primarily on other aspects of the rural economy also require agricultural production data. Rather than focusing on the behavior of the farmer in his role as an agricultural producer per se, these studies focus on other problems that rural residents face, such as consumption, nutrition, and health choices. Other studies examine the interaction of rural residents with the urban environment and explore economic choices in the nonfarm sector. In sum, the world of the rural household and farmer transcends the agricultural enterprise.

In these broader studies close attention still must be paid to farming activities because of the central role of agriculture in most rural economies. Further, the wealth base of the household usually depends heavily on farming assets. With this perspective, researchers identify what aspect of the agricultural production process is important to their own study and concentrate on collecting this information.

A study primarily concerned with consumption or nutrition issues approaches the data collection task differently from one concerned with the behavior of the agricultural producer. Agricultural production studies need to be designed to understand how the agricultural production process functions and the structure of the production environment instead of just the outcome. In other words, it is important to understand how and why the farm income was produced, not just how much.

Consequently, data needs for research on agricultural producers are more intensive than for studies on other aspects of the rural economy. Practically, this intensity means that data often needs to be collected on a more disaggregated basis, for example, by crop, by plot, and/or by household member. In contrast, in nonagricultural studies, farm production is considered because of the amount of income it produces and/or the quantity of labor it uses. Data collected on farm activities in these studies includes information that allows researchers to measure farm income and labor. Often there are less intensive methods of collecting data and estimating these quantities.

TECHNIQUES FOR COLLECTING FARM HOUSEHOLD DATA

Regardless of the final objective of research in rural areas, data collection *techniques* are basically similar. Most farm household data is collected using one of two strategies: (1) the *survey method*, which is based on farmer recall and usually recorded by trained enumerators; and (2) *recordkeeping*, during which households record data.

The survey method is most commonly used to collect farm production information for many reasons. Surveys do not require a literate population. They can be more flexible in terms of the size of the research area and sample number. Finally, the less intensive nature and reliance on a longer recall period make the survey method less costly in terms of time and money for studies of equal size. Recordkeeping, however, provides a viable alternative. This method potentially offers richer and more accurate data because of the shorter recall period and finer detail.

Because agricultural production activities are very complex, and some critical variables are sensitive to measurement error, data collected either with surveys or household recordkeeping frequently must be supplemented by other means. Examples of these supplemental data collection methods include *direct measurement, observation, historical interviews, supplemental and key informant interviews*, and *data from secondary sources*. Supplementary methods are not by themselves used to collect a complete set of farm production data. However, data from these sources can be used to enhance the quality of survey or recordkeeping data. In the third section of this series, we examine both primary and supplementary methods of data collection.

PAPER ORGANIZATION

The remainder of this paper is divided into three major sections. The first section concentrates on major *conceptual issues* involved in collecting data for household production studies. The section is divided into three subsections: (1) defining the household unit; (2) conceptualizing important measurement issues; and (3) valuing nonmarket goods and transaction costs.

The second major section discusses *methods and organization*. The main subsections provide a brief description and analysis of (1) methods of collecting alternative primary and supplementary data; (2) methods of organizing the data collection; and (3) common measurement problems found when collecting data pertaining to output, yields, land, and other inputs.

The final section contains a summary and conclusions.

2. CONCEPTUAL ISSUES

The scope of potential topics on conceptual issues is very broad. As with the entire series of papers, topics chosen were based on discussions among the six authors, and only those issues that seemed fairly common to all of the studies were included. The section on farm production data created more interest, however, because all of the authors collected farm production data. At some point, each researcher dealt with these questions and many other conceptual issues when facing the task of designing and/or implementing a survey and/or recordkeeping system. In some sense, this working paper series highlights the points of intersection between diverse groups of studies. The inclusion of topics that arise in such a wide range of situations should make the material applicable to many other studies of the rural economy.

DEFINING THE FARM HOUSEHOLD UNIT

The farm household is not always easy to define. This is especially true in developing economies where the lines between parts of the extended family, the divisions between production and consumption activities, and the separation between on-farm and off-farm enterprises are all less than clear. The point at which divisions are made is itself shaped by the focus of the study. Other region-specific factors, such as the structural and cultural characteristics of the rural sector, also affect this definition.

Limits can be drawn in three dimensions. These include a horizontal dimension (i.e., the scope of activities); a vertical dimension (i.e., how far should farm production extend in production planning through marketing); and a physical dimension (i.e., which physical assets should be considered as part of the production process).

A careful definition of the boundaries of the farm production unit is important for several reasons. If the study focuses on the agricultural production process, this exercise helps the researcher avoid missing the collection of significant variables. Second, and sometimes as important, it helps to distinguish what belongs to the farming process and saves the researcher the time and expense of collecting data of marginal value. If the researcher is considering broader questions in the rural economy, careful definition delineates the position of the farm and its activities in relation to other rural activities.

Scope of Farm Activities

At first glance, the number and types of activities considered to be agricultural enterprises seem clear. Most researchers define "agriculture" as all cropping and livestock enterprises performed on land that is controlled by the farm household. This definition is true but not complete. The farmer may consider other activities to be as farm activities as well.

Farmers themselves do not consider all "farming activities" as such, even though in many study sites some of these tasks receive substantial allocation of household resources and contribute significantly to farm income. Tasks that fall into this category often differ significantly from site to site and country to country. For example, in many areas farmers do not consider gardening to be a farm activity. The centrally planned equivalent to a garden in the China study was the "private plot;" farmers often did not offer information on inputs or outputs of this land, because it was considered to be outside the interest of anyone except the family. In the Philippine study, root crops and perennial crops grown primarily as feed on upland sites were often overlooked. Crops grown on "marginal land," such as bunds and dikes, sometimes contribute significantly to household production but are frequently omitted.

These types of inconsistencies can be identified during preliminary site selection and pretesting trips. Then their importance should be assessed. An activity that is of little consequence to family welfare may be excluded. Sometimes a supplemental survey on a subset of the farmers is sufficient to capture the magnitude and variability of some of these activities. Whatever method is used, the survey should explicitly state which items are included or excluded.

Many activities are clearly neither cropping nor livestock tasks but in some areas or under certain interpretations can still be classified as agricultural. Examples encountered frequently include "logging" of trees on household land, cultivation of perennials in nursery-type operations, raising of fish in ponds on household land, and gathering of wild plants and small animals. Although the activity is located on the farmer's land and competes for labor, it is not normally defined as agricultural.

The solution lies in carefully defining where the information should be placed or even if it should be collected at all. In the China study, the general agricultural survey was designated clearly as a crop survey (partly because, in a land-scarce environment, few land resources are claimed by livestock or other enterprises). Any activity that involved crop cultivation, whether annual or perennial, was included. Other activities, such as livestock enterprises, fish-raising activities, and logging operations, were placed in a separate block entitled "non-cropping activities." An example of an atypical form is provided in Appendix A.

The Degree of Vertical Reach of the Farm Household

Where does the farm production process begin and where does it end? The answer, as with other concepts in farm production research, depends on the purpose of the research. In most pure production studies, the farming process is frequently defined as starting with preparation and production and ending with marketing. Most studies included in this series excluded all processing of agricultural products (e.g., milling of grains or ginning of cotton) from farm production data, unless the process is required by regular marketing channels.

Studies with a broader focus than agricultural production (e.g., a consumption and/or time allocation study) generally start the agricultural process at the same point. At the other end, however, nonproduction studies do not always include marketing activities in the farm production section; transactions are often captured in expenditure and/or time allocation sections.

Collecting information on the extreme ends of the production process often has its own set of difficulties. For example, in gathering information on labor allocation in the production process, effort spent on the preliminary, prefarming activities must be considered. These activities, which include attending extension sessions, procuring inputs, and negotiating contracts, are often useful and significant. If information is collected by crop, information on preparatory activities can be difficult to attribute to a particular crop. Specifically in the China study, enumerators expressed frustration in attempting to collect these data. Although farmers *could* identify tasks performed during the precultivation period, they could *not* break up time by crop.

The Farm's Asset Base

Defining the asset base of the farm is important for determining wealth, changing the production process, and measuring productivity. The extent of coverage of the farm production survey should first be decided. The researcher must explicitly decide which assets belong to the farm production process, and then collect information on these assets consistently across farms. In cases where household assets are used for both on-farm and off-farm activities, a system is needed to divide the asset's value and use among the different activities. (The reader is directed to Belbase's *Collecting General Household Information Data* in this series for a discussion of the conceptual, methodological, organizational issues involved in collecting baseline farm data.) The section on collecting current and fixed asset data is included in the capital subsection of the methods and organization section of this paper.

CONCEPTUALIZING MEASUREMENT ISSUES

Modern quantitative analysis requires good data. Data collection strategies need to be developed to get accurate measurements of the important research variables. Experience and careful work are necessary to any data collection program. In addition, a series of principles can be applied to help improve data quality. This section discusses two of these measurement principles: (1) understanding and establishing the farmer's unit of measure; and (2) establishing the optimal level of disaggregation.

Understanding and Establishing the Farmer's Unit of Measure

A crucial step in constructing a data collection strategy involves the selection of the unit of measure. Should data be collected by plot, by crop, or by some higher level of aggregation? Should labor be broken down by individual, by sex, or by some other grouping? Should inputs be elicited on a per unit basis or on a total expenditure basis? The following two subsections address these questions.

The basic idea is to choose a unit that will be familiar to the farmer, yet will not allow answers couched in generalities or in gross averages. On the one hand, the unit should conform to the way that the farmer manages the farm enterprises. On the other hand, it should make the farmer critically reflect on the season in question to recall the *actual* quantities or values. Selection of units for reasons of accuracy because of aggregation are discussed in the next subsection.

With regards to the first part of the requirement, farmers in different areas think in different terms, organize their crop and other agricultural enterprises in different ways, and separate their farms into different management units. The researcher tries to understand these methods of thinking and incorporate them into the data collection design.

In the China study villages were small, and the land within a village was relatively homogeneous. Farmers rarely engaged in intercropping, and as such they thought about and planned their farm management schemes in terms of each crop, regardless of how many different plots or parcels were devoted to an individual variety. In the Philippines, however, intercropping was common, and the quality and location of each plot largely affected the farmer's production decision and the resulting output. Farmers managed their resources not only on a crop by crop basis, but also on a plot by plot basis.

Thus, collecting information by plots was essential to the Philippine study, given the management strategy of farmers and the focus of the study. But considering the nature of the research objective, however, little additional substantive information could have been gained by collecting plot information in China. In fact, making Chinese farmers report input by plot possibly could have been harmful, because it would have forced them to mentally *disaggregate* information prior to responding. An additional mental step accomplishes little in terms of improved data accuracy, while adding another burden to the recall process. On the other hand, if in the Philippine study, the basic unit was the crop rather than the plot, the farmer would have had to have aggregated the figures in his mind before being able to respond.

In selecting the correct unit, researchers attempt to make it easier for the farmer to respond by casting the question in terms conforming to those used in managing the farm. However, there is a flip side to this principle. Questions also need to be structured in a way that does not encourage the farmer to respond in gross averages. For example, instead of providing the enumerator with information on the levels of inputs that are *typically* put on the fields, the farmer should instead delineate what was *actually* used.

An example of this danger is illustrated in a scenario that is familiar to almost every researcher who has collected data in rural areas of a developing country. The researcher sits down to interview a farmer, but is surrounded by curious fellow villagers, adults and children alike. The researcher tries to clear the house to reduce pressure on the often bewildered farmer, but with little immediate effect. Even after most of the crowd has become bored and finally dispersed, relatives, neighbors, or concerned local headmen frequently remain. The enumerator asks a question. "How much fertilizer did you use on your rice fields last season?" As the farmer starts his or her process of recall, suddenly two or three other people in the room call out decisively, "100 kilograms per hectare!" The farmer, who is being watched by the enumerator, nods his head either in resignation or in appreciation of the help. The farmer is probably thinking that the figure is really not too far from the actual level applied. If the enumerator is satisfied, no argument needs to be started and no additional effort needs to be exerted.

The problem with such a situation is obvious enough. If it happens several times in a survey containing several hundred observations, the statistical harm is minimal. If it happens continually, however, either bias or a lack of statistical robustness can enter many records. Although the most obvious solution lies in enumerator training and the establishment of a disciplined enumeration environment, the selection of the unit of enumeration will minimize the problem.

Questions that lead the farmer to answer with "historical averages" are best avoided. In practice, the use of "per-land-unit" input usages encourages farmers to give less precise answers. The survey form or recordkeeping system should be formulated to encourage farmers to give the quantity used in physical terms and in overall expenditures. In the ideal system, quantities *and* expenditures on inputs are queried in *different* sections of the survey. After enumeration, a review procedure can be established to make sure that the two figures can be reconciled. This is very time consuming, and in some studies, the extra data precision may not be worth the additional effort. As a compromise, quantities and total expenditures can be asked at the same time. A discussion in the methods and organization part of this chapter looks at related practical issues of collecting data on current inputs.

Another good example of this principle is the collection of household price information. A form that asks for the price per unit *on each purchase* will come much closer to getting seasonal opportunity costs of resources than either one that asks for a single price or one that depends on deriving prices later from dividing expenditures by quantity information.

In summary, the key in selecting the correct unit for enumeration is to balance two opposing tendencies. On the one hand the unit of enumeration should make it more difficult for the farmer by *making* him or her actively think when recalling the actual quantity applied. On the other hand the unit should make the process easier by *helping* the farmer's recall process and avoid making him or her produce distorting intermediate mental calculations.

The Level of Disaggregation

A closely related data collection strategy involves the question of how far to disaggregate the data. Assuming an appropriate unit of enumeration, there is still considerable latitude for collecting information on a more or less disaggregated basis. Here, too, the unit of disaggregation is influenced, but not completely determined by the research objectives. The overall concern is to get the most accurate data possible, subject to money and time constraints. Of course, the focus of the research does influence what proportion of a fixed budget will be spent on each block of a data collection effort. For example, in a rural consumption survey, a smaller proportion of the budget will be spent collecting farm production data (since farming only adds to income), and this will influence the level of disaggregation.

Generally, the more disaggregated the level of enumeration, the better the resulting data. More disaggregation means more prompting. And more prompting leads the farmer to provide more complete data with fewer omissions and less double counting. On the negative side, besides the additional time and expense, too much disaggregation can exacerbate respondent fatigue.

The potential for disaggregation is always great and thus leaves the researcher with many choices. In collecting labor data for crop production, for example, total labor use can be broken down by source of labor (family, hired, and exchange); by crop; by plot; by task (plowing, weeding, and harvesting); by family member; and by season. The selection of the level of disaggregation is influenced by the issues discussed above. Beyond this consideration, however, many other dimensions of disaggregation remain open to the researcher.

VALUING NONMARKET GOODS AND MEASURING UNOBSERVABLES

This section on valuing nonmarket goods provides guidelines in answering the following questions: How are goods that are not bought and sold at the market valued? How are the correct prices collected? Which prices are appropriate for family resources and family produced, nonmarketed goods? Does the observed price capture the entire cost paid or revenue collected? All of these concepts are familiar from the most fundamental economic courses, and few would dispute their importance. Yet these issues are among the most debated, the most elusive, and the least understood.

This section examines how to value inputs and outputs involved in household transactions that do not go through the market.

Valuing Inputs and Outputs Outside of the Market

The answer to the question of how to value nonmarket goods is theoretically straightforward: value the goods at the market price. The value of a good is equal to its worth at the margin. Or equivalently, a good is valued at what it would take to replace it from an alternative source.

In practice, the process of determining the true value of a good is not always easy. The question posed in this series is how do we develop a data collection strategy and survey instrument which will best measure the value of a nonmarketed good? And more concretely, what additional steps are necessary in the data collection process to ensure that this information is available and as accurate as possible?

The best solution to valuing nonmarketed goods is to ensure that a complete set of prices is collected. Prices come from two general sources, directly from the household or from the market itself. The easiest is when a family carries market transactions with a good in a fairly complete market. Here, the price elicited from the household for the portion of the goods actually sold at the market is the best one to use. In this case, the nonmarketed portion of the good is valued at the price that the farmer would have received if the good had been sold.

When a product is actively bought and sold in a fairly complete market, the problem is still relatively easy to solve, even if the household has not marketed its product. With competitive markets, household-specific prices and market prices should be nearly the same. Prices used for evaluating the nonmarketed goods can come from the market the family would have used if it had sold part or all of its product. For example, a farmer produces a staple grain, which is consumed entirely by the family. In this case, the total value of that output is the output quantity multiplied by the market price. Steps to collect village-level or market data are discussed elsewhere (see, for example, Wood and Knight 1985; Scott 1991).

The issue is less clear without a clearly defined market or prevailing market price. Examples of such crops include certain fruits and vegetables, subsistence crops (such as cassava, sweet potatoes, and coarse grains), and many other minor crops. Sometimes one or two such crops constitute nearly the entire output of a household. Other times each crop by itself contributes little to overall income, but as a group the proportion can be quite substantial.

Several approaches can be taken in assigning values to these crops. The options are listed in order of preferability:

1) prices from local or regional markets (even if only periodically available, though a seasonal adjustment may be required);

2) prices from other individual households either in the survey proper or from a supplementary survey;

3) prices for close substitutes from any of the two above sources; and

4) prices from national or regional secondary statistics, though some adjustment may be required to make price levels compatible with local variations.

Each of the above methods provides a less than ideal value for nonmarketed crops. These approximations must be made carefully, and it is often useful to have more than one source for comparisons.

Data on minor crops can be collected in accordance with the supplementary surveys or key informant surveys discussed in the next section of this paper. Price data for nonmarketed goods can also be elicited from a subset of households. Subjecting all households to detailed questions about the value of minor crops does not necessarily provide significantly more information and often results in respondent fatigue.

The researchers can often choose between market-level price information from a village and price data from the household. The correct price for farm analysis is the one that the household actually pays for an input or receives for an output. A major criticism encountered in using household-specific price information is that variations between households are often caused by other factors (such as an internalized loan amount, transportation costs, or quality differences). These differences can explain some types of economic behavior. In other types of price analysis, however, these figures are inappropriate, since they include more than price.

Consequently, household price data must be collected with care. First, the problems inherent in the derived price (taken from total expenditure or revenue divided by quantity) were discussed in the previous section on the unit of enumeration. Prices should be elicited directly but with attention to questions of seasonality, source of purchase, quality of purchase, and other components included in the price, such as transportation, packaging, and terms of purchase (e.g., cash, credit, or payment in kind).

Information gleaned from these data collection techniques not only provides insight on the nature of the economic environment in which farmers operate, but it also guides the determination as to which prices are appropriate.

3. METHODS AND ORGANIZATION

The previous section examined major *conceptual issues* faced by researchers when devising data collection strategies for farm production. General principles were integrated with practical suggestions. This section is even more practically oriented. Nonetheless, these suggestions are not always the best solutions to particular problems in all situations. Rather, they are simply based on the collective practical experiences of the authors of this series. One objective is to highlight advantages and disadvantages of the different methods under various conditions. Armed with this assistance, researchers can weigh the costs and benefits of alternatives within the context of their own situation and make their own choices. Included are (1) a brief description and analysis of the alternative primary and supplementary data collection methods; (2) an overview of methods for organizing the data collection effort; and (3) a description of common measurement problems. The last subsection looks specifically at methods to collect data on output, yields, and inputs, including land, labor, capital, and other current factors.

DATA COLLECTION TECHNIQUES FOR FARM HOUSEHOLD DATA

Regardless of the final research objective in rural areas, data collection *techniques* are basically the same. Most collectors of farm household data must rely on one of two strategies for obtaining fundamental information: (1) the *survey method*, using farmer recall, which is recorded by trained enumerators; or (2) the *recordkeeping method*, which allows the household itself to record its agricultural production transactions.

However, because agricultural production activities are very complex and some critical variables are sensitive to measurement error, data collected either by survey or household recordkeeping often must be supplemented by other means. Examples of supplemental data collection methods include *direct measurement*, *observation*, *historical interviews*, *supplemental and key informant interviews*, and *data from secondary sources*.

The method of primary data collection and the decision to use supplemental methods depend on many factors: the objective of the study; the methods used in other parts of the study; the financial and time resources available to the researcher; and the characteristics of the targeted farm households. Examples of both primary methods and many supplementary data collection activities can be found among the six studies in this manual. The same factors that determine the choice of methods also influence decisions about the frequency of data collection. These tradeoffs are the focus of discussion in this section.

This chapter is not a guide on how to set up surveys or the recordkeeping system. "How-to" references for survey methods include Casley and Lury (1987) and Hunt (1969). Shaner, Philipp, and Schmehl (1982) provide the best guide to establishing recordkeeping systems. These sources also cover many mechanical steps involved in conducting a general data collection program.

Primary Methods

Most agricultural production data is collected either through survey or through recordkeeping. The survey method, in brief, involves a team of enumerators going into rural areas and eliciting farm production data via answers to questions on a structured form. Recordkeeping is when families are given a series of account forms to record their agricultural enterprise transactions as they occur.

By far the most common methodology for farm production studies is the survey method. Five of the six studies in this series relied on this method. Furthermore, either method can be used whether the study is focused on the agricultural producer or not. The China study, one of the two studies focused on farm production, used survey methodology. However, in the Philippine study, the other study that concentrated on the behavior of the agricultural producer, the researcher adopted the recordkeeping approach.

When comparing the two primary methods, survey methodology has the primary advantage because a large number of observations can be collected in a more concentrated period of time. The sample can be spread over a wider area, which has statistical value, as well as making the study somewhat more generalizable. Moreover, because of the interaction between enumerator and respondent, the questions can cover a wider scope of subject matter and more complex issues.

Recordkeeping methodology, however, has many features that overcome weaknesses found in studies based on surveys. Whereas the survey relies on farmer recall (sometimes up to a year after the activity has taken place), recordkeeping enables the recording of data that is still very fresh in the farmer's mind. The detail, accuracy, and variability over time achieved with successful recordkeeping make it feasible to study certain complexities of behavior or environment of the agricultural producer.

Furthermore, recordkeeping forces the researcher to spend a lot of time working with households in keeping their records. Frequent visits, regular consistency checks, and availability of disaggregated data give the researcher deep insights into the behavior of the farmer. In the Philippine study, the researcher intimately knew each of the households in her study village. Undoubtedly, the personal relationships established between researcher and respondent positively affect data quality.

Recordkeeping and its intense demand for supervision of participating households is very time consuming. In the Philippines 51 households in a single village were studied, the smallest sample size of any of the studies included in this series. Despite the relatively small sample, the researcher felt it was important to live in the village itself and spent 18 months there.

Surveys, on the other hand, concentrate less on the details associated with a specific set of households in a village, spreading the study focus over a wider area. This allows studies, such as those in Indonesia and China, to cover study sites in different provinces hundreds of kilometers away. The Nepal and northern Malawi studies surveyed areas in vastly different agroclimatic regions. Diversity in geographic, political, and agronomic regions infuses statistical variation that might not exist among households in a single village.

Surveys also allow the principal researcher to spend much less time in the field. None of the authors of these papers who relied on the survey approach for collecting farm data lived full time in the village. That is not to say that participants were not fully involved in studying the local economy – each spent an average of five months of each year in the study villages. However, the time spent with any one group of farmers was necessarily less than if the researcher was living in a single village. Although there was a certain loss of intimacy with respondents and familiarity with factors in the local economy, the ability to live in a larger population center offered other advantages, such as better facilities for project administration and data entry, access to secondary resources, and more comfortable living conditions.

Leones' paper in this series (*Collecting Time Allocation Data*) also contains a discussion of the advantages and disadvantages of the survey methodology and recordkeeping systems. Many of the key points made in that paper can be applied to the discussion of farm production data collection.

Supplementary Methods of Data Collection

Regardless of the overall strategy adopted for collecting basic farm management data, other data collection activities must supplement most survey and recordkeeping efforts. Direct measurement, direct observation, historical interviews, and data from secondary sources are frequently used to supplement the basic data. Agricultural economics research focused on the behavior of the producer is more likely to require these data. Even for studies requiring only limited input from the farm production sector, however, the sensitivity of critical farm variables to measurement error means that certain variables require special attention. Frequently, supplementary data are needed for measuring some farm variables.

Direct Measurement. The most important type of supplemental data collection method used to gather farm production data is direct measurement. In the China study, yield cuts were taken on sample plots and yield estimates made on all crops. In the southern Malawi study, great effort was expended to accurately measure the land area. In the Philippine project, the researcher took soil samples for most plots.

Direct measurement is used when there is reasonably strong doubt about whether the farmer knows the value of a variable. Most frequently, researchers use direct measurement methods to enumerate land, yields, outputs and sometimes even for certain current inputs. However, because higher expense and time is generally required by direct measurement, additional effort is usually reserved for measuring variables that are critically important to the study objectives. Often information on directly measured variables can also be elicited from the farmer. A judgment must be made as to the value of the more accurate information vis-à-vis its additional cost.

As an example, the most frequently encountered problem requiring direct measurement in agricultural production studies is obtaining accurate measure of yields or accounting for total output of a certain crop. Farmers often do not know their exact yields for many reasons. Farmers often do not have the means to weigh their output. They sometimes harvest their products over a long period of time. Aggregation and multicropping can confuse good overall yield estimates. In some areas, farmers do not know the size of their plots. In other areas, local land measurement units differ from area to area.

But even in areas where farmers should know their cultivated area and total output, the validity of farmer estimates is still sometimes doubtful. Different factors may induce a farmer to purposely inflate or deflate estimates. Yield figures can be associated with factors such as the status of being a good farmer; the level of an agricultural tax or marketing quota; and the eligibility of the farm household for participation in a program.

Despite these problems, accurate yield estimates are important in calculating farm production and farm income. Errors in total household production created by yield inaccuracies often profoundly affect study results. Since biases in important variable estimation can systematically vary with other household characteristics, such as education or overall income, benefits accrue from approaches that minimize enumeration biases. The researcher must address the question of whether the value of the additional information outweighs its cost in time and money. Time constraints and financial resources are important factors in determining how much direct measurement activity can be performed.

Direct measurement itself invariably involves error. Care needs to be exercised in setting up and administering direct measurement programs in the same way as for carrying out the survey proper.

Continuing with the yield example, one study shows how, even with all of the factors weighing against accurate yield estimates by farmers in Africa, own yield estimates under some circumstances were the best measure of true yields (Verma, Marchant, and Scott 1988). This situation arose largely because yield estimating techniques are frequently poorly executed in developing countries, even by supposedly trained personnel from technical stations. In the China study, although great additional expense was put into collecting direct measured yield data, there was a high correlation between the magnitude and variability of farmer-estimated yields and the yields of the same plots directly measured by technical station personnel.

Even a result like this is not worthless, however, as the exercise can instill confidence or caution in the use of the data. In cases where budgets are tight, directly measuring a subsample of the households could serve as a check of accuracy. Properly sampled, partial enumerations can frequently be used to pick up systematic biases in the data and provide grounds for making reasonable adjustments.

The measurement of yields is only one example of direct measurement. In the next section, practical suggestions and other sources of references are given for methods of direct measurements of output, land size, and soil quality.

Direct Observation. In the late 1970s, agricultural economists from the International Rice Research Institute (IRRI) conducted a supervised study in the Philippines to collect farm production data by *directly observing* the inputs and outputs of the farmer production process (Herdt and Mandac 1981). Researchers concluded that while such a methodology provided good insight on certain farm behavior and picked up some errors found in survey methods, the high expense made it infeasible to apply generally in farm production studies.

The paper by Leones in this series (*Collecting Time Allocation Data*) also contains a section on time allocation, specifically the use of direct observation as a method of collecting time allocation data. Some of the observations made there can also be used to determine the usefulness of this method in the collection of farm production data.

Direct observation does play an important role in every farm production data collection program. All of the authors in this series similarly concluded that direct observation played an important role in assessing the reliability and completeness of some data. By observing what parts of the farming system were missed with the original survey design (e.g., crop production done on bunds and dikes in China; and certain secondary crops in the intercropping system in Nepal), midsurvey corrections could sometimes be instituted. These corrections often included revising the questionnaire and/or training the enumerators. Even if corrections were infeasible, an understanding of these biases are useful during later analysis.

Direct observation is particularly important when some physical process or structure affects production but possesses characteristics making it difficult to simplify into neat and concise categories. For example, the researchers must sometimes assess the effectiveness of irrigation (Dick 1989). In the China study, qualitative information on farmer composting practices at first defied systemization in the survey instrument. Only after each farmer's practices were observed and catalogued was there enough information to construct a quantitative variable for use in production analysis. Moreover, some agricultural economists find mapping farmers' plots to be an effective means of understanding differences among farms in a village, as well as aiding in the collection of other farm household data (Hunt 1969).

Secondary Data. In many cases, there are sources of data that households cannot provide but which are valuable and even necessary for analyzing farmer behavior or calculating farm income. Examples include (1) data from village, regional, or national markets; (2) data collected by local technical station representatives, researchers, extension specialists, or other government offices; (3) data from on-farm crop experiments; (4) data from earlier surveys; and (5) data from other agricultural institutions that might have records on individual farmers (e.g., lending institutions or land offices).

Sources for these data are numerous and vary greatly from country to country. Scott (1990) provides an excellent review of the sources and uses of secondary data. Spending time during the initial phases of the research assessing the availability of secondary data can greatly simplify data collection, improve data quality, and possibly save some expense. For example, secondary data used in the Nepal study saved enumerators' time and expense in measuring plot size. While farmers in some of the areas did not know their field sizes, researchers discovered that the local land office had certified field measurements for every piece of land in the area. Double-checking confirmed their accuracy, and the result was a reliable set of data on a critical variable that is often difficult and expensive to collect.

Access to certain information can give a set of data from a single year a much greater significance. By having data beyond the cross section itself, the scope of analysis can be broadened. If the existence of a previous study or data set is known, an astute choice of sample villages can give a study such a time dimension. For example, the Nepal study was designed to resurvey the same set of villages that another researcher had looked at 15 years previously.

In subsequent sections of this paper, other examples of places where secondary data are useful are cited. The main point to remember is that collecting these data often requires planning in advance. Also, time is often required to understand the content of the variables in order to ensure their effectiveness.

Other Supplementary Data. Many other sources of supplementary data can be used: key informed interviews; historical interviews; supplementary surveys; etc. Most of these are not required in all studies. However, data collected using some of these methods aid in understanding the entire socioeconomic framework of the village economy, in putting the study into perspective, and in collecting information on variables considered common to most village residents.

Among the most useful techniques is the *key informant* interview. This method involves interviewing a person (or persons) in the village who is in a position to know key facts about the entire village economy. Interviews are not only helpful during study preparation and sample selection, but they often allow the collection of village-level variables that affect the behavior of all households in the village (e.g., the agricultural calendar; labor migration; and irrigation system efficiency).

Another supplementary method, the *historical interview*, gives important insights into current practices,providing a time dimension even if no previous study was done in an area. In the China study, information elicited on the history of technology adoption is being used to explain current high-yielding variety use. In general, historical interviews yield accurate information if the event is of some consequence for the farm household. For example, a researcher in Indonesia reported that land purchase values were recalled accurately by farmers up to 20 years after the transaction (Tumari 1989). Migration, adoption of a radically new agronomic practice, a major disaster, an important purchase, and a new job are all events that farmers remember vividly and that may still affect current farm behavior.

The *supplementary survey* is done on a small group of farm households selected on the basis of the type of data required by the researcher. It is used to collect information on a whole array of minor variables that may be important in the aggregate, but would be time consuming to gather in detail for every household. Ideally, the variable varies relatively little from household to household and, more importantly, does not influence farmer behavior in other farm production activities. For example, the China study employed this method to collect input and output data for many minor household activities, such as small fowl raising, egg production, vegetable cultivation, and fuel production.

The purpose of collecting this information is to obtain a more complete measure of farm income and labor use. The information is usually used to create several variables (such as "miscellaneous income") that can be appended to household income. As such, selection of the subsample is generally based on a random sample or random stratified sample.

Another common application of the supplementary survey is to obtain more insight into technical parameters the average farmer might be either unaware of or unable to explain clearly. Examples include input timing parameters, losses or gains from alternative production practices, and village market variables (e.g., prices, distances, timing, and transaction fees). Unlike the collection of miscellaneous income data, which most likely depend on a random subsample selection, the supplemental survey usually is conducted using a special set of farmers with the ability, experience, and/or training that provide the most accurate insights. In this respect, the supplementary survey is similar to a key informant interview.

ORGANIZING THE DESIGN OF THE DATA COLLECTION EFFORT

This section will present principles and organizational precepts that aid the researcher in developing a data collection strategy. These principles of design can be used on two levels. First, for organizing the entire farm production survey or recordkeeping system; and second, for creating a series of questions to efficiently and effectively collect information on a single set of related variables (e.g., how to account for the sources and uses of the total production of a certain crop).

This section provides three approaches to organizing the collection of farm production data — the "production function" approach; the "income statement" approach; and the "balance sheet" approach.

The "Production Function" Approach

The production function is among the agricultural economist's most fundamental analytical tools. A production function relates the inputs required for any production activity to the output of that process. The interest here, however, is not in performing this kind of analysis. The production function as a concept is itself useful in organizing the design of a data collection strategy.

The China study researcher built his survey explicitly on this abstraction. A production function can be written as

Output = f(Land, Labor, Chemical Fertilizer, Organic Fertilizer, Capital, and Other Inputs).

The sections of the crop production forms were designed with the following format:

I. Output
II. Land
III. Labor
IV. Chemical Fertilizer
V. Organic Fertilizer
VI. Capital
VII. Other Inputs.

Within each of these blocks, data were collected on a "by crop" basis. Practically, this means that all quantities and expenditures for a single input (fertilizer, for example) are collected at one time for all of the crops.

This strategy has several advantages. First, the format is easily understood by enumerators and respondents. By comprehending the pattern of the questions, participants better understand the significance of the current question and of the relationship of this question to the other parts of the survey. This likely has a positive impact on the data quality.

To ensure the value of this approach, trained enumerators in the China study took farmers briefly through an outline of the survey before starting. The enumerators felt that many farmers understood both the significance of certain questions and the logic behind the order in which questions appeared. This was made evident by farmers' comments showing that they comprehended why they were being asked certain questions. For example, in a situation where one input was linked to another (e.g., the use of spraying equipment and labor for insect control), after answering the labor questions, several responses referred back to the section when asked about capital utilization ("I used the sprayer whenever

I was doing insect control work, and you asked me that when we were discussing 'labor'").

Another advantage of the production function strategy is that it provides a natural avenue for establishing cross-checks. All inputs are enumerated in distinctly separate blocks. Often, combinations of certain inputs can point to data inconsistencies in one section or the other. For example, a cross-check in the China study permitted researchers to quickly assess the "accuracy" of each questionnaire. In the land section, the farmer provided information on the area planted to each crop. In the fertilizer section, the farmer gave information on how much *total* (not a per land-unit figure) fertilizer was used on each crop. Well-established maximum (agronomically determined) and minimum (administratively encouraged) levels of nitrogen and phosphate usage were known. Any deviation above or below these limits pointed to an inconsistency in the data of that particular survey.

The production function approach is useful particularly in helping to logically structure a data collection program and account for all agricultural activities. The approach does, however, have limits. The production function is a technical concept and cannot, per se, account for economic behavior. Each of the sections in the China study was modified to contain questions pertaining not only to physical inputs, but also to prices, expenditures, and other pertinent characteristics of the inputs and outputs.

This overall approach has other drawbacks, however. Repetition of the same questions on each crop is time consuming. Moreover, the approach is designed to collect information that may be more detailed than many studies require, especially those not concentrated on producer behavior. Furthermore, when there are "joint-inputs," the enumeration of one input is often made more accurate when answered within the context of a question asked about another. For example, in the China study, labor expended on plowing and the time that bullocks or tractors were used are the same. Consideration of both of these factored concurrently may have led to a more accurate recall of both variables.

Similarly, other data collection designs can use a more streamlined "production function" approach. A less detailed approach to data collection involves asking about all inputs for a single crop or group of crops simultaneously. In the Indonesian survey the production blocks were set up in this manner. An example of this abbreviated method is given in Appendix B. With the exception of labor input, this form elicits all relevant input and output data for the study's major crops.

The "Income Statement" Approach

An income statement is a system of accounts that tabulates the gross revenue of the farm enterprise, deducts the expenses, and arrives at net revenue or profit. In a strict accounting sense, only *current* income and expenses should be included. The purpose of the income statement is to provide an accurate accounting of the profitability of the current year's business.

From a conceptual standpoint, this approach is consistent with studies aiming to elicit net farm income. Although it is feasible that the entire questionnaire can be organized around the structure of the income statement, the questionnaires and the recordkeeping systems used in the studies in this series did not. Probably the most notable survey utilizing this paradigm is the United States agricultural census household survey, suggesting that this approach may better fit households in a developed economy, where farm records are kept in a way that facilitates such a survey design.

This fact, however, does not diminish the usefulness of the income statement concept as a model for organizing data collection, especially when structuring individual pieces of questionnaires. There are two main benefits associated with adopting this framework. First, as with the production function approach, it helps ensure data continuity and completeness. Second, it avoids the "gross or net" problem. When asking a farmer about income generated by a certain enterprise or activity, clarification is always needed as to whether the number is net of expenses or not. The structure of the income statement approach ensures that only net income is measured.

The concept of the income statement is adopted in many parts of the studies covered in this series. In accounting for miscellaneous income earned from minor fruit and vegetable sales, livestock enterprises, and other sideline agricultural activities, researchers in the China study formulated a table based on an income statement approach. Appendix C is an example of the table used to tabulate income from the sales of poultry products, livestock activities, and other noncropping farm production processes. The table also accounts for some of the major noncash expenses, as well as marketing costs. Off-farm activities were enumerated elsewhere in the survey form.

In the Philippine study, the recordkeeping system for livestock activities also conforms to the "income statement" approach. Appendix D reproduces the form headings on the revenues and expenses received from livestock activities filled in by farmers. A large part of the data collection effort in this study (part of Form 6 and most of Form 7) was focused on gathering and quantifying noncash costs and revenues incurred on the household's fields (e.g., use of feed produced on the farm and use of the draft animals on own plots). These items should not be valued by the farmer, but an accounting of all major allocations of the farm household's resources is required.

The "Balance Sheet" Approach

The balance sheet approach, like the income statement approach, is based on the accounting discipline. In accounting, the balance sheet tracks the increase in and disposal of assets and liabilities belonging to an enterprise or business. Like the "income statement" concept, none of the overall data collection efforts are fully based on this model. Moreover, this approach is not likely to provide the principal underlying structure for anything but a study focusing on farm financial issues.

In many areas, however, the concept is useful in both agricultural production and nonproduction studies. *Collecting Consumption and Expenditure Data* by Carol Levin describes how this concept can be used to enumerate many variables or sets of variables relevant to rural research.

This approach also has several uses in agricultural production studies. Appendix E, taken from the China study, is based on the balance sheet principle. The table is designed to obtain all sources and uses of all of the major food crops, oilseeds, and feed crops produced by a household in one season. Besides this function, the balance sheet approach can be used to account for sources of cash for production inputs, for credit transactions and repayments, and for use of family labor.

In the example shown, this approach was used to track the disposal of crops during data collection in the second round. By putting all transactions on a single table, an enumerator with a calculator can make sure the table balances before proceeding to the next section of the survey. When using this table, other problems, such as missing plots, overestimated yields, market purchases, and receipt of gifts can become apparent when balancing crop outflows and inflows. Many problems and omissions encountered in the first round of the same survey, which involved collecting essentially the same information but in a less systematic fashion, were solved using this approach. Analysis of the data showed significantly fewer discrepancies in the overall data set in the second round when the balance sheet approach was used.

SETTING UP THE SURVEY

In this section, other practical suggestions to aid researchers designing data collection strategies are provided. The discussion centers on moving the researcher from conceptualization of the form of the data collection strategy to the beginning of the creation of the survey instrument or recordkeeping system. The three main issues are (1) how to determine which crops, inputs, and other agricultural activities should be "built in" to the survey instruments; (2) what set of mechanisms in the instrument will ensure coverage of these principal farming activities; and (3) finally, how the researcher decides if an important variable requires a special direct measurement effort.

Before the Survey

The *presurvey* process is among the most important, but typically least emphasized elements involved in creating the survey instrument or recordkeeping system. A thorough presurvey is the key to understanding the most important enterprises, cropping patterns, input mixes, and farming techniques in a sample area. This information is required to finalize the design of the survey instrument or recordkeeping system. The development of a comprehensive precoding system, discussed in the next section, relies on information collected during the presurvey.

The main objective of the presurvey is to collect an exhaustive list of outputs and inputs, requiring that the exercise be done with a wide cross-section of the final sample sites. Other tasks are also done during this process. For example, the appropriate level of disaggregation and the variables that require direct measurement are determined. In the China presurvey during the first round, only village leaders or their close associates were asked to fill in the form because of convenience and expedience. The relatively high position of the initial respondents, however, distorted the view of the typical crops and inputs used by most of the farmers in the village. To correct this shortcoming, during the pretesting phase for the second season, a small but *random* subsample of households was chosen. The data obtained from this more representative group allowed for a near complete identification of crops and farming practices before final revisions were made to the second round survey instrument. The presurvey can also be based on one or more of the supplementary survey methods (e.g., key informant or stratified random subsample), as discussed in the section on supplementary data collection methods.

Setting Up a Precoding System

A major advantage of obtaining an exhaustive list of major crops, varieties, and inputs prior to drafting the final survey is that the researcher can use this information to build a comprehensive precoding system. Structuring the form to include codes has several benefits. First, as discussed in the section on general principles of data collection, prompting the respondent always helps eliminate missing observations. Second, consistency is built into the data across households. If major crops are all represented in a uniform tabular form, each household provides information on the same set of crops and fills in the form in the same order. Finally, entry of production data and use of the information after collection is facilitated.

Appendices F and G show two tables from the China study, one from the first round *without* a designated column for precoded crops, the other from the second round *with* this information included. In conjunction with the experiences from the different survey rounds, these tables help illustrate the advantages of precoded forms. In the first round of data collection, the enumerator was asked to fill in the crop type in the left-hand column of the example table (Appendix F). Simple as this exercise may seem, several problems arose. Often the crop was given a different name when moving from table to table within a single household. For example, although the respondent was referring to a certain variety of rice, it was written in the form as "ratooned rice" in one table, variety "34-1" in a second table, and simply as "middle rice" in still another table. This "nomenclature" problem was magnified when moving among households within a village, and among villages.

Other problems frequently arose when precoded forms were not used in the China study. Enumerators periodically forgot to ask farmers about a certain crop on one of the forms only. In other cases, when a farmer did not use an input for a certain crop and the column was left blank, enumerators were asked to double-check whether the blank was a missing observation or a zero entry. Another source of potential error arose when data entry personnel tried to assign code numbers to the crop names written into the tables. Inaccuracies and inconsistencies caused by the assignment of wrong crop codes can only be removed by long hours of data cleaning.

Including crops and their preassigned codes directly on the second-round forms (Appendix G) overcame many of these problems. However, implementation of this step required the time and expense of conducting a careful presurvey of the farming systems for the second season. In systems with many different crops or with complicated and highly variable intercropping or multiple cropping systems, complete coverage can be difficult to obtain. When a precoding system is used and a small subset of crops or inputs are missed, there is actually a higher probability that enumerators and respondents will not notice these one or two excluded activities. In some cases, no precoding might be better than partial precoding. In general, however, the payoff in data quality and reduction in data cleaning accruing from a complete precoding system is substantial.

Direct Measure or Survey?

This section discusses the process through which the researcher decides whether the survey response provides sufficiently accurate data or if supplementary measures (that is direct measurement) are needed for certain variables. The researcher always faces the dilemma as to whether or not the variable is important enough, the project's resources sufficient enough, and/or the estimates by farmers inaccurate enough to warrant *actual measurement* by a research team. When is direct measurement required? What variables require special treatment? If needed, how is a direct measurement procedure selected?

As seen in the conceptual section, the evidence is mixed as to when direct measurement is required for many variables. Some claim that the error involved in many direct measurement procedures introduces as much error as that found in survey or recordkeeping estimates. Others have found that direct measurement of some variables in certain situations is the only viable means for getting data.

One final question certainly crosses the minds of researchers throughout every study. How can we determine if farmer estimates are accurate? There is no pat answer, but common observations by members of this research group led to several generalizations. Above all, the farmers themselves provide the most decisive evidence. Most farmers will bluntly and directly say that they do not know the answer to a question. They also often indicate if an estimate is difficult to make. Not every comment by every respondent is true, but if a comment on the difficulty of providing information is repeated, it is probably true.

Similar insights can be obtained from key informants before the data collection system is designed, but frequently a headman or village leader will misjudge the farmer's ability. In some cases, the farmer's ability is overestimated; in others, it is underestimated. Some leaders think that although they may be able to estimate a certain variable, the average farmer cannot (when, in fact, frequently they can!). Other leaders, who may be trained agriculturalists, may think knowledge that is common to them can also be easily obtained from farmers (when, in fact, most farmers cannot understand certain concepts). When assessing reliability of responses to questions, all groups of households need to be considered.

An early review of data from responses to questions suspected to be subject to large estimation problems also reveals this kind of problem. If two households have similar characteristics, yet certain variables vary greatly between the two, this can indicate a problem. Once a variation is uncovered, further investigation into the cause of the difference, such as a follow-up inquiry, can uncover the source. Discovering the sources of measurement inconsistencies may or may not lead to supplemental data collection efforts. The researcher can live with the problem; try to solve the problem analytically later; subsequently refine the questionnaire; or use a method that directly measures the variable.

MEASURING CRITICAL VARIABLES

In agricultural production studies one group of variables plays an important role in most agricultural operations. This section looks at methods for measuring output, yields, land, labor, capital, and other production factors. The discussion primarily focuses on methods for constructing data collection instruments for their effective enumeration. This discussion is organized using the "production function" approach as discussed in an earlier section. The final part of the section reviews a variety of measurement issues on a set of miscellaneous topics, including establishing *standards*, estimating *transaction costs*, and collecting data on multiple *cropping systems*.

Output and Yields

Sown area and yield determine the output of a crop. Coming to an output figure either involves direct estimation or the estimation of sown area and yield components. Here we examine the question of how to estimate output and yield, given a known land area. The following subsection examines how to estimate land area.

Output. Unless all output is gathered at one location at one time, it is difficult to measure output directly. In some countries, all output is stored in one location – a storage bin, in bags in a warehouse, or some other space. If so and if the harvest occurs at one time, then a special effort to estimate the total harvested output can be relatively inexpensive. In these special situations the main additional variables that are needed are beginning inventories and amount of "leakages" for transactions during the harvest such as in-kind wage payments, loan repayments, and gift dispersals. The timing required to directly estimate output is critical. Enumerators must be present immediately after the harvest has been completed. Furthermore, enumerators will need considerable analytical skills to estimate quantities from volume measurements of bin bags and other storage facilities. Even so, error still exists. This method should be considered supplementary to other estimation methods. Hunt (1969) includes a section on steps that can be used to measure output directly.

Another way to estimate output is to use "indirect" methods. Spencer (1989) devotes a concise section to describing these methods.

> There are several possible variations of this [indirect output estimation] method. Farmers can be interviewed at the end of the crop year and asked to estimate the quantity of each crop harvested during the year. Questions on family consumption and sale of the crop can be included provided units are recorded in local measures. These local measures can then be converted to standard units by applying rates determined by the researcher.
>
> In another version of this method the quantities of the harvested crop allocated to different uses are recorded as they occur. Quantities consumed at home, quantities sold, gifts, etc. are carefully recorded. This "consumption study" approach was used by Zuckerman in his study of Yoruba smallholder cropping systems [through International Institute of Tropical Agriculture, Ibadan, Nigeria] and requires a very high visiting frequency.

Yields. Typically, most researchers rely on yield estimates in order to arrive at an estimate of total agricultural output. Alternative strategies for collecting yield data include:

(a) estimates obtained directly from farmers – prior to and after harvest;

(b) crop cutting methods; and

(c) third party estimating methods.

While the first of these methods can be incorporated into a survey form or recordkeeping system, the others require supplementary collection. Each offers a viable alternative for collecting yield information. Since the accuracy of this variable is so important, however, many researchers choose to use more than one. Yield estimates from the Malawi study were obtained using the first two methods. Researchers in the China study used a procedure (described below) involving all three methods and asked farmers about their yields twice. Regardless of which physical measurement program is used, most researchers elicit yields directly from farmers. Enumerators should get yield estimates from farmers as soon after harvest as possible for the best estimates.

Another problem is that farmers may respond to queries about yields with historical average harvest figures (e.g., "I get about 2 tons per hectare every year"). The earlier discussion about structuring a survey to keep farmers from giving historical averages is especially relevant here. One way to avoid this problem is to collect yields by plots, if such information can be solicited.

Yield information, however, is not always easy to collect. In some countries, farmers have incentives to chronically over-report or under-report yields. Even without these bias-inducing tendencies, farmers cannot always accurately supply this information. In general, in regions where land is less scarce, per land unit measures are more difficult to enumerate accurately.

When interview techniques do not elicit accurate yield information, researchers tend to rely more on direct measurement methods. In general, yields can be directly measured in two ways: *crop sampling techniques* and *judgmental reporting*.

There are many different *crop cutting methods*. A detailed description is beyond the scope of this chapter. Good references include Hunt (1969); Verma, Marchant, and Scott (1988); and Spencer (1989). The Malawi study provides an example of the yield estimation process called the "yield plot" method (also described in Spencer [1989] for a study on Sierra Leone; and in Norman [1973] for a study on northern Nigeria). In this method, a field technician stakes out a plot in one of the farmer's typical fields. When the farmer harvests, he leaves this plot, which is cut and measured by the technician soon afterwards.

Norman (1973, 22-23) used similar methods and provides a critique of this method.

> ...this classical method of estimating yields...was of limited value for a number of reasons. First, many of the fields contained more than one plot, each of which usually contained at least two crops in mixtures. Thus a large number of yield plots was required. Yields of individual crops tended to fluctuate greatly from one part of the plot to another. Therefore more than one yield plot per plot of land was needed to obtain reliable estimates. Secondly, pegs demarcating yield plots were often eaten by termites or removed by children. Finally, if an enumerator was not present farmers tended to ignore the boundaries of the yield plots during harvest.

In Norman's study, because of the problems he encountered with crop cut methods, he combined that information with data from both his survey results and a direct weighing exercise and used a "modified average," which ignored extreme values.

Researchers in the China study also used a combination of all three of the yield estimation methods. First, the farmer was asked for a yield estimate within three weeks after harvest. These estimates were elicited on a plot by plot basis. Farmers were asked to explain abnormally high or low yields.

The "five point" crop cut system, a traditional method used by local agricultural technical agents, was used. Crop cuts were made two or three days *before* the farmer's harvest. Five one-square-meter cuts were taken from the farmer's field, one from each corner and one from the middle. The grain was threshed, dried, and weighed before the yield was calculated.

The "five point" method overcomes some but not all of the problems of using the "yield plot" method. Cuts are routinely taken from all parts of the plot. Moreover, because cuts are taken before the farmer's harvest, there is no problem with the farmer removing the grain from the designated crop cut area. This method does, however, rely heavily on good timing and close communication with farmers and village leaders. It is still subject to the common problem of crop sampling: overestimation (due to choosing only fully mature plots to cut, as opposed to a random sampling). Furthermore, the method is time and labor consuming if the land area of a household is fragmented and variable across parcels.

The third method employed by the China study researchers was to use an "estimating team," which consisted of two or three "experts." The personnel were typically drawn from local extension or technical stations. The group was led to all or at least a substantial portion of the farmers' plots close to harvest time. The team estimated yields based on experience and technical knowledge. The greatest advantage to such a "judgmental reporting" system is that it results in one set of objective estimates for all plots in the sample from a single source.

The researchers in the China study took advantage of the strengths of each of the three methods, while minimizing research costs. They questioned farmers about their yields immediately after harvest during the household survey. An estimating team also gave estimates on at least one plot of each crop for every household. These data were supposed to capture the interhousehold variability, but it was too expensive and time consuming to estimate every plot of every household. Finally, crop cuts were done on one plot of each crop of one-fourth of the sample households to get a set of figures on the actual level of the harvest that could be use to "calibrate" the other two sets of figures. Examples of the tables used to record the supplemental data are included in Appendix H.

In these cases, the critical issue researchers face during data analysis is the accuracy of farmers' estimates. When is a more elaborate data collection system for yields needed? The answer to these questions largely depends on the location of the research area. In the six studies featured in this series, farmers' yield-estimating abilities varied widely. Indonesian and Chinese farmers easily provided estimates on yields of almost all crops and could even relate differences in yields within the household's own fields to variations in cropping practices and land characteristics. Filipino and Nepalese farmers gave fairly reliable yield estimates on certain crops but not on others. Farmers in the two Malawi studies had great difficulties in providing yield estimates for most crops. In general, the more land scarce a region, the more attention farmers pay to land productivity, which is linked to yields.

This indicates that while a farmer's yield estimates may be acceptable in land scarce Southeast Asia, some direct measurement effort is required in relatively land abundant African countries. A study of five African countries

(Benin, Central African Republic, Niger, Zimbabwe, and Kenya) funded by the World Bank, FAO, and other organizations, however, comes to a surprisingly different conclusion (Verma, Marchant, and Scott 1988). Researchers found that farmers' estimates in the immediate postharvest period were at least as accurate as some of the popular estimates obtained through physical measurement, although they recognized that direct yield measurement methods also are subject to error. Expenses and constraints on sample sizes and distribution associated with physical measurement programs make this result important in terms of weighing the cost and benefits of implementing this type of data collection efforts.

Land

Land area is the companion component to yield in estimating total production. Two major issues are involved with the land variable when considering data collection. First and most basic, the researcher must know how much land is involved. Second, land parcels, even those of the same size, vary greatly in productivity and in the production practices that farmers use on them.

Land Area. In some areas, farmers' estimates of land area are very precise. In the China study, farmers in the very densely populated areas of the Yangtze Delta report their plots to the 1/1,500th of a hectare. In these areas, once yields are known, the researcher can confidently get total production estimates. Conversely, African farmers in some areas and farmers in other land abundant, upland environments frequently do not know how much land they are using. As evidence of this, many local languages have no words with which to measure land area.

If farmers do not know land size, researchers are forced to physically measure all plots the farmer has. In the Philippines, Malawi, and Nepal studies, researchers felt it necessary to measure plot areas. There are different ways to compute land areas. Belbase's paper on household characteristics and asset ownership has an extensive discussion on several of the most feasible ways to measure land area.

Besides land size, many other factors affect a parcel's output. Additionally, many farming practices, crop planting decisions, input levels, and, hence, productivity measures depend on certain characteristics. While these elements may not be particularly useful for a nonproduction focused study, in studies where production is of central importance their explanatory power is sometimes quite large.

Many different elements determine the quality of a piece of land. Some common land characteristics that affect quality are natural fertility, location, geology, and the degree of water control. Some of these can be determined through a carefully designed questionnaire. Others are technical enough that only direct measurement produces a variable useful for production or income analysis.

Appendix I is a reproduction of a form used in the China study, which helped discover key characteristics that determined land quality. Enumerators asked for five pieces of information that affect land quality: (a) the irrigation system; (b) the distance of the parcel from the farmer's home; (c) the degree of slope of the land (a key determinant of crop selection in Chinese agriculture); (d) a subjective index of soil quality; and (e) a disaster code.

The main problem with these questions (especially the slope, soil quality, and disaster variables) is that it is difficult to establish a uniform standard. Dick (1989) suggests how to more rigorously account for the effects of irrigation. Problems with measuring distance in terms of time are discussed in the paper on time allocation. An appendix in the paper on household characteristics and asset ownership explains how to quantify slope characteristics of land. Appendix J shows how testing for soil quality was conducted in the Philippines.

Labor

Many of the general problems involved with enumerating *labor* are discussed in the paper on time allocation. Although time allocation studies typically collect labor data in much more detail than required for most production-focused studies, many fundamental principles of data collection are applicable in both situations. The subsection on data aggregation in the "conceptual issues" section of this paper used the collection of production labor data as an example on the different ways to collect better and more accurate information from farmers.

Appendix G (which was used to illustrate another point above) shows a table used in the China study for enumerating crop production labor. In this study, labor was disaggregated by source, task, crop, and family member. The table in the appendix is one of ten tables used to collect information on family labor. (Another table was used to collect hired and exchange labor.) This table was used specifically to collect information on labor used in rice transplanting. The ten production tasks included in the breakdown are:

Land Preparation and Seedbed Maintenance
Plowing
Transplanting and Sowing
Weeding
Fertilizing
Insect and Disease Control
Water Control
Harvesting
Threshing
Storage and Marketing.

Although the breakdown is quite detailed, the level of disaggregation is justified given the production focus of the China study. An example of a nonproduction rural study was Levin's work, which did not require collection of production labor information to the same degree of disaggregation. An example of this form is shown in Appendix K. The Indonesian production labor form was used to collect nearly all of the same information as in the China project, except labor data were only disaggregated by rice and all other crops. Also, information on labor by household members was not collected.

Because of the intensive labor needed for many tasks in the production process, recordkeeping methods should work well for collecting labor information. Appendix L is an example of the form used in the recordkeeping system in the Philippine study. Its use is discussed in detail in the paper on time allocation.

Capital

The third major category of productive factors is capital. Capital goods in farming include both the household's resources used to purchase and consume inputs in a single season as well as fixed assets used by the producer for several periods. Capital goods include assets that are owned and used by the farmers and those that are rented and borrowed. This section concentrates on long-term capital goods that are owned, rented, borrowed, or hired under a service contract. Short-term capital is often divided between a farmer's own resources (or his money reserves, including cash, deposits, and other liquid reserves) and borrowed resources. The series of forms for enumerating credit used in the China section in Appendix M is included for completeness.

The most difficult issue in collecting information on fixed capital equipment is to assess how much of the item is actually consumed by the production process. How does the use of this input affect production? When is its use converted to an expense, and how much should be deducted from gross income? Long-term capital inputs are not exhausted in a single production period and are sometimes termed "lumpy inputs."

Aside from equipment and tools, two issues face the researcher. First, the data collection strategy must be so crafted that the researcher can discover how much of the value of the asset is consumed during the season. After this value is established, the second step is to allocate the expense among farm activities and between farm and nonfarm activities. Only the proportion accounted for by farm activities is used in the production analysis.

The China study used two forms in the capital block to account for lumpy capital inputs. Appendices N and O illustrate this portion of the China survey. The first form establishes the value of major equipment in terms of its purchase price, the number of years it has been used, and the number of years of use still available. The researcher has the choice of many different accounting techniques to assign value to any one-year period during the life of the tool.

The second form, Appendix O, enumerates the use of the tool or equipment in terms of the amount of time each item was used on each crop, and allows for the allocation of the total season's expense among individual crops. Finally, if a tool or piece of equipment is rented out or used for a nonfarm activity, this information is picked up in other parts of the form to allow expense charges to be allocated between farm and nonfarm activities.

Irrigation systems can also be considered another "lumpy input." Accounting for the effect of irrigation on farm production can be very complex when a researcher tries to untangle the actual effects of the operation of the system and timing of the water control activities. Most surveys only gather data on the use of irrigation facilities and on the amount of water fees paid. This approach completely ignores the quality of the facilities and does not differentiate among crops or fields. Dealing with these issues is beyond the scope of this manual, however. The best reference on this subject is found in Dick (1989).

Current Inputs

Current inputs are considered to be all factors farmers purchase for cash in a given season that are completely consumed within that period. The importance of these as inputs into the production process is usually correlated with some measure of the degree of modernity of the agricultural sector. In some areas, farmers buy virtually no inputs for cash; in others, cash outlay is quite large. Variations among farmers affect greatly the behavioral parameters and net income level of the farming process.

The *Methods and Organization* section of this chapter discusses the importance of identifying key inputs used in the production process with a presurvey. Once the scope of the inputs is understood, a tabular format to capture these inputs is relatively easy to formulate. Appendices P, Q, and R are examples of tables from the China study concerned with collecting fertilizer and insecticide data. The main point to emphasize is that in both of these tables, information is requested by crop and by input type. In the case of insecticides, one column includes queries about the type of input, including the chemical content of the insecticide, the percentage of effective ingredients, and the insect it targets. An effort is made in all cases to elicit prices paid by the households for the current input.

The examples for collecting current input are all from an intense of the economics of production. Many studies require considerably fewer detailed data. When determining farm income is the major objective, a different data collection strategy can be faster, and less costly. Appendix S has an example of a form from the Malawi study that was used to elicit fertilizer data as part of a crop by crop summary of major production activities.

METHODS FOR OTHER DATA ISSUES

In this final section practical tips are provided for dealing with a set of miscellaneous data collection problems. The first subsection examines how to establish data collection standards and focuses on how to convert volumetric measures into units usable for analysis. The second topic looks at methods for accounting for transaction costs. Finally, steps are outlined for collecting data in systems characterized by complex and extensive multiple cropping systems.

Standards

A standard is defined as a "rule established by an authority to allow for the measure of weight and quantity...and that will serve as a basis of comparison." A problem arises in rural areas of developing countries when weight, value, and quantity standards are not well established. Establishing reliable measurement standards in data collection programs is important for maintaining the quality of data in both production and consumption studies. In her paper in this series, Levin devotes a section to this issue. It is equally important, however, to understand the potential consequences of the "standards problem" in farm production surveys and recordkeeping systems.

The basic problem is that different groups of respondents use different standards in reporting inputs and outputs, making comparisons between groups and evaluations of productive activities difficult or inaccurate. The problem exists not only among villages and regions, but also among households in a single village. The overall problem can be divided into four smaller problems for discussion: (1) the conversion of local units to internationally recognized units; (2) variations in local standards; (3) accounting for an agricultural good at different stages of growth or processing; and (4) the conversion between volume and weight measures.

Most basic is establishment of constant conversion rates between local units of measure and internationally recognized units of measure. The Food and Agricultural Organization periodically issues a manual on technical conversion factors for many countries (Food and Agriculture Organization 1960). This problem can usually be addressed after the data are collected.

A more immediate problem is caused by differences in measure standards among respondents. At one time in China, in a total of 152 study sites, there were 109 different conversion rates for cultivated areas from "mu" to hectares; and over 130 different conversion rates for weight measures from "jin" to kilograms (Buck 1937). This problem has been largely resolved in China in recent decades, but it remains a serious issue in some developing countries. The major solution is to carefully document local conversion rates.

Another frequently encountered problem arises primarily because a single agricultural good frequently has different uses, values, and physical properties during different stages of growth and processing. Chinese has at least six words for rice, each one used depending on the state of maturity or of processing of the product. The word for rice varies if the rice is in the seedbed, in the field, on the threshing ground, in a storage sack to be sold or stored, at the miller, or in a steaming bowl on the table. "Raw" cotton and ginned cotton both have the same generic name, but value and weight vary by a magnitude of three in these different states. Similarly, Filipinos have four words to describe maize, depending on the state of maturity of the stalk.

The problem lies in keeping track of the stage of processing and in recording the information in a form that will later allow proper evaluation and analysis. This problem frequently reduces to one of language. Its solution is often found in carefully choosing vocabulary or defining terms during the survey. Attention to language details in survey instruments and recordkeeping systems aids in reducing confusion. Frequent stress on the unit of enumeration is helpful in maintaining consistency.

Finally, a prevalent problem arises when farmers use an imprecise measure of *volume* to report an input or output that must be converted to a *weight* measure. Farmers in Malawi, Indonesia, and Nepal all frequently thought in terms of the number of bags of fertilizer when estimating usage. When the number of bag sizes is limited and correlated with a particular type of fertilizer, using bags to enumerate is acceptable as long as the bag types are verified. Under these conditions conversions to weight is easily accomplished.

More serious volumetric problems, however, are not as easily solved. In the Philippines, farmers would report their harvests of some upland crops in number of bags, number of cans, or some other volume measure that varied from household to household. In Malawi, baskets, which were frequently used for carrying harvested products, varied in size and shape. Unlike the case of bags of fertilizer from a fertilizer outlet, these harvest and storage containers did not all hold a standard weight.

Moreover, the problem was not confined to output measures. Some households in the Philippines purchased fertilizer in their own containers. A problem with measuring the "quantity" of pesticide was encountered in each of the studies, because it is typically purchased "by the bottle," and containers are not standard sizes. Moreover, even if two bottles were the same size, they could contain products with very different effective chemical compositions.

The solution to the volume-to-weight problem is less satisfying. Just as in consumption studies, the weight of product included in the container is estimated on a case by case basis. The researcher needs to ask for greater detail on the size, shape, and frequency of use of the different containers. This is both time consuming and subject to measurement error. The degree to which this estimation exercise is undertaken depends on the importance of the variable, which requires measurement throughout the study. Sometimes the researcher's financial and labor constraints force less precise estimation.

With respect to measuring the "quantity" of effective farm chemicals, total value is a common proxy for quantity. This assumption is valid if there is a set price for active chemical content, which was the case in several study countries. In Malawi, the government regulates the unit price of certain farm chemicals, and the quantity could be recovered from price and expenditure information. In the China study, value had to be used because farmers applied a wide variety of farm chemicals, and there was no common unit except value over which they could be aggregated.

Transaction Costs

Prices (both paid and received) differ among households partly because of unequal access to markets. Moreover, although two households may face equal nominal prices, hidden costs can make the effective price of one considerably higher than the other. Transaction costs, for instance, differ widely. Economists use transaction costs to explain differences in the behavior of farm households in the same locale. Agricultural producer studies often require an understanding of this concept and accounting of these costs. At times these costs can account for a large, frequently overlooked, part of income and may be of interest in all studies of the rural economy.

Transaction costs can be denominated in time, money, and lost opportunity. Measuring certain time and monetary transaction costs is feasible for some categories of these costs. Because of the wide variety of transactions, however, enumeration sometimes defies systemization.

Appendix T presents the format used to collect transaction costs of marketing agricultural commodities in the China study. Other tables were used to collect data on the quantity of sales and prices received for crops sold by variety and by transaction type. This table was designed to elicit information on market characteristics, the number of trips, transportation means, fees and time spent, and miscellaneous expenses, including licensing and stall fees. Although certainly there are other transaction costs, the survey contained questions on these because presurvey testing identified them as the major marketing costs to farmers in this area.

4. CONCLUSIONS

This chapter has focused on conceptual and practical issues involved in the design of a data collection program for farm production studies. Data collection efforts for farm production generally are based on either a survey methodology or a recordkeeping system. The pros and cons of the two systems, as well as alternatives offered by the two systems when collecting different types of information, were both discussed. Much of the discussion has centered on when the alternative data sources are needed because great accuracy is required or because traditional enumeration techniques are inadequate. Appendix U summarizes some of the major findings and categorizations brought up in this chapter.

This chapter was written with comments relevant for studies focused on agricultural producer behavior, as well as for more general studies on the rural economy, both of which need information on income from and labor used in farm enterprises. Accurate data are required for both types of studies, but pure production studies often involve the collection of both more disaggregated and more detailed data because of analytical requirements. The frequency of data collection and sample size in production studies are often more flexible than for other studies on the rural economy.

Principles of organizing the whole or even a subsection of the data collection procedure were the subject of an important section of this chapter. Three of the suggested organizational models included the "production function" approach, the "income statement" approach, and the "balance sheet" approach. These approaches are suggested because they give the researcher a structure to follow when designing the data collection operations. The objective is to provide a logical, consistent, and complete framework for data collection. Additionally, such a methodological framework often aids enumerators and even farmers in their "interaction" with the data collection instrument.

The collection of farm production data is part science and part art. Good preparation, an unhurried presurvey data testing procedure, and the application of the basic principles presented in this series and in alternative sources provide a solid starting point for the farm production data collection operation. This paper does not answer all of the questions a researcher might ask. However, many references are provided. If the reader is unable to gain access to all of the papers in this series, journal articles, and photocopies referenced in this chapter, Casley and Lury (1987), Shaner, Philipp, and Schmehl (1982), and Hunt (1969) are useful, comprehensive, and accessible.

No amount of preparation will allow the researcher to foresee all problems. In fact, many methodology choices are made knowing they are less than perfect, because of financial or time constraints. Once a data collection effort is started, good researchers and primary data collection administrators constantly track the project's progress. Finding weaknesses in the data, adjusting survey instruments in "mid-stream," finding supplementary sources for variables that are particularly important and/or are recurrent problems in the primary enumeration attempt are key to data integrity, and these steps contribute greatly to the ultimate success of the analysis.

APPENDIX A

EXAMPLE OF FORM FOR NONCROPPING ACTIVITY – AQUACULTURE

1. Is there a contract fee?		|____| yes =1; no = 2
2. If yes, how much?	|____|yuan	
3. Do you manage your own pond?		|____| yes = 1; no = 2
4. How large of area?	|____|	
5. What is total investment in fish enterprise (yuan)		|____|y
a) pond construction		|____|y
b) equipment		|____|y
c) boat and fishing year		|____|y
d) other________ (specify)		|____|y
6. Total Revenues (yuan)		|____|y
a) fish sales - fresh		|____|y
b) other aquatic product sales		|____|y
c) processed fish product sales		|____|y
Total Expenses:		|____|y
Total Interest Expense		|____|y
Interest Rate	|____%|percent	
Total Hired Labor		|____|y
Wage	|____|y/jin	
Feed		|____|y
Price	|____|y/jin	
Fertilizer		|____|y
Price	|____|y/jin	

Appendix A (continued)

"Seed" Fish		|____| y
Price		|____| y/jin
Processing Costs		|____| y
Marketing Costs		|____| y
Transportation	|____| y	
Other	|____| y	
7. Family Labor		
Production		|____| days
Person 1 Code:_____		|____| days
Person 2 Code:_____		|____| days
Person 3 Code:_____		|____| days
Processing Labor		|____| days
Person 1 Code:_____		|____| days
Person 2 Code:_____		|____| days
Person 3 Code:_____		|____| days
Marketing Labor		|____| days
Person 1 Code:_____		|____| days
Person 2 Code:_____		|____| days
Person 3 Code:_____		|____| days
8. Feed from Family Stocks		|____| jin

Type of Fish Production (jin) Price (y/jin)
1.
2.
3.
4.

APPENDIX B

EXAMPLE OF TABLE DESIGNED UNDER THE MODIFIED "PRODUCTION FUNCTION" APPROACH

I.D. Code |__|__|__|__|__|__|

BLOCK D

D.1 INPUT USE FOR WETLAND AND DRYLAND - SECONDARY CROP PRODUCTION

1. Total Area :__________ Ha.
2. Total Parcels :__________
3. Land Use Status:__________ (Code)

4. Fill in the following table for the input used for each crop planted

Input	Unit	Crop				
		1	2	3	4	5
1. Crop Code						
2. Area Planted	Ha.					
3. Seed Variety: ________						
3.1 Quantity						
Own						
Purchased						
Gift, etc.						
Credit						
TOTAL QUANTITY	Kg.					
PRICE PER UNIT	Rp.					
TOTAL VALUE	Rp.					
4. Fertilizer						
4.1 Urea Quantity						
Own						
Purchased						
Gift, etc.						
Credit						
TOTAL QUANTITY	Kg.					
PRICE PER UNIT	Rp.					
TOTAL VALUE	Rp.					

Appendix B (continued)

- CODE -

LAND USE STATUS:

A. Own
B. Rent
C. Share
D. Mortgage
E. Borrowed
F. Combination

CROP CODE:

A. Rice Paddy
B. Corn
C. Soybean
D. Groundnuts
E. Other Beans
F. Cassava
G. Sweet Potatoes
H. Tobacco
I. Melon
J. Semangka
K. Vegetables
L. Coconut
M. Coffee
N. Other: ______
______

Input	Unit	Crop				
		1	2	3	4	5
4.2 TSP/Phosphate						
Quantity						
Own						
Purchased						
Gift, etc.						
Credit						
TOTAL QUANTITY	Kg					
PRICE PER UNIT	Rp.					
TOTAL VALUE	Rp.					
4.3 KCL Quantity						
Own						
Purchased						
Gift, etc.						
Credit						
TOTAL QUANTITY	Kg.					
PRICE PER UNIT	Rp.					
TOTAL VALUE	Rp.					

Input	Unit					Crop
4.4 Animal Fert.						
Own						
Purchased						
Gift, etc.						
Credit						
TOTAL QUANTITY	Kg.					
PRICE PER UNIT	Rp.					
TOTAL VALUE	Rp.					
5. Pesticides						
Own						
Purchased						
Gift, etc.						
Credit						
TOTAL QUANTITY						
PRICE PER UNIT	Rp.					
TOTAL VALUE	Rp.					

APPENDIX C

EXAMPLE OF FORM SET UP UNDER SIMPLIFIED INCOME STATEMENT APPROACH

Income from Family Livestock Enterprises: (since April 1988)

	Qty	Revenue (yuan)	Feed from Family services (jin)	Which type of feed (Code)	Costs				Labor spent marketing by member			Transport and marketing costs (yuan)
					chicken ducklingpiglets etc. (yuan)	feed (yuan)	vet. fees (yuan)	other fees (yuan)				
chicken												
duck												
goose												
eggs												
other												
hog												
baby hog												
other pork by-products												
other "meat" animals												
silk coccons												
sows												
sales of waste from milling rice												

APPENDIX D

RECORDKEEPING SYSTEM TABLES DESIGNED ON "INCOME STATEMENT" APPROACH

Form 5 Family #_____ Animal Record
Animal type_______________________________

Date Event-death, birth, sale, purchase, # animals, cost/# illness, affected income remain

---

Form 6 Family #_____ Animal Feed Record

Date Type of feed quantity Value Own, Purchased, or Given

Form 7 Family #_____ Carabao Work Record

Date Task Who Used carabao rent/wage Hrs. worked

Form 8 Family #_____ Outside Income Record

Sources of income:

Date Quantity Income Expenses Profit

APPENDIX E

EXAMPLE OF TABLE DESIGNED UNDER "BALANCE SHEET" APPROACH, USE AND DISPOSAL OF WINTER CROPS

	Wheat (71)		Rape seed (72)		Barley (73)		Other	
Total Production								
Quota Sales								
Negotiated Sales								
Market Sales								
Own Consumed								
Feed								
Seed								
Other								

Note: Row 1 should equal 2 + 3 + 4 + 5 + 6 + 7 + 8.

APPENDIX F

EXAMPLE OF TABLE THAT DID NOT USE PRECODING

Part 1. Family Labor--On Farm

In this section include only unpaid labor of the household used on the crops being grown this season. Do not include hired labor. Do not include labor from previous season.

1. For each person in the household, fill in the following tables that provide information on the amount of labor each person has spent on specific farming tasks for each crop.

a.) Work in seedbed: [include preparation of seedbeds; planting; taking care; purchasing seeds and plastic; etc. do not include transplanting]

Person	HYBRIDS	HYVS	OTHER-1:	OTHER-2:

b.) Plowing and Land Preparation: [do not include spreading Organic Fertilizer; Transplanting; Labor spent by others]

Person	HYBRIDS	HYVS	OTHER-1:	OTHER-2:

APPENDIX G

EXAMPLE OF TABLE FOR ELICITING DISAGGREGATED LABOR DATA

Family Labor Usage:

3.1 How much labor did different family members use on the various production activities?

3.1.1. Land preparation (clear off previous crop waste; level; plow; dig in field drainage ditches; bund)

Member Code	Wheat DJ-71	Rape Seed DJ-72	Barley DJ-73	Other Winter Crop (use code) DJ--:	Perennial Crop (use code)

3.1.2. Planting (seeding; seedbed care and preparation; transplanting)

Member Code	Wheat DJ-71	Rape Seed DJ-72	Barley DJ-73	Other Winter Crop DJ--:	Perennial Crop (use code)

Code: Other winter crop code:
DJ-84: broad bran
DJ-85: green manure
DJ-89: other:
specify:

Perennial crop code:
QT-52: mint
QY-53: mulberry
OC-64: lotus
OC-66.6: ramid

APPENDIX H

EXAMPLE OF TABLE USED TO RECORD YIELD ESTIMATES — "JUDGMENT REPORTING" AND YIELD CUTS

Household I.D.	Name	Total		Plot #1				Plot #2			
		AREA	TOTAL PRODUCTION	AREA	PRODUCTION	YIELD	VARIETY	AREA	PRODUCTION	YIELD	VARIETY

Plot #3				Plot #4				Results of Yield Cat Specify Plot; Variety/Yield
AREA	PRODUCTION	YIELD	VARIETY	AREA	PRODUCTION	YIELD	VARIETY	

APPENDIX I

EXAMPLE OF TABLE DESIGNED TO RECORD LAND DATA

By Plot Information on 1988-89 Winter Crops

Winter Crops							
Plot No.	Size of Plot (mu)	Crop this Season (Use Code)	Irrigation Method (Use Code)	Land Quality (Use Code)	Distance from Home (Minutes)	Tenure (Use Code)	Yields
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							

Appendix I (continued)

Winter Crop			Next Season (summer) 1989			Last Season (summer) 1988				
Plot No.	Disaster Code (use code)	Who checked on crop (use code)	Over-lapped with winter crops 1=yes 2=no	Crop next season	Who will decide? (use code)	Over-lapped with winter crop? 1=yes 2=no	Crop last season	Who decides (use code)	Yield	Disaster Situation (use code)

Disaster Code:
1 = flood
2 = drought
3 = insect infestation
4 = hail
5 = frost
6 = ____________
other:________

Who decides on crop variety to be planted:
1 = own decision
2 = "unified management" by village
3 = "unified management" by township
4 = collectively decides by several households informally
5 = other: ______________________________

APPENDIX J

TAKING SOIL SAMPLES

A wide range of chemical and physical properties of soil can be analyzed by soil laboratories. Many soil laboratories are located in developing countries, often at the country's major agricultural colleges or in facilities associated with the Department of Agriculture. However, in order to have such analysis done, the researcher has to know how to collect and submit a soil sample. The purpose of this appendix is to discuss one common procedure used for collecting soil samples. However, it is a good idea to contact the laboratory where you plan to have the analysis conducted to request a copy of their guidelines for collecting samples. Collecting samples is time consuming and requires some skill. You might consider hiring a graduate soil science major or an agronomy college student to collect samples and to facilitate submission and follow up.

First, the properties of the soil most commonly analyzed using soil samples are the percentage of organic matter, the amount of phosphorus and potassium, the pH, and the texture of the soil. This is the basic information used in making fertilizer recommendations to farmers. However, a researcher may also request analysis of other elements and micronutrients, such as magnesium, calcium, manganese, copper, iron, sodium, and aluminum, as well as particle and bulk density, and analysis of the structure of clays present in the soil. However, these types of analyses may be more costly than the standard analysis described above.

Most laboratories issue forms such as the one in Appendix Table J.1, which are submitted with the sample. The basic information on these forms includes the date, the name of the farmer, the location of the plot, cropping history of the plot, present and future crops, size, and topography of the plot.

The first decision which the researcher must make in sampling a field is whether the whole field is similar enough in terms of topography, productivity, texture, structure, color, drainage and past management to be sampled as one unit. In areas where different farmers have small contiguous plots, this decision may involve deciding how many of these small plots can be included in one sample, based on the same criteria. Generally, flat areas and hilly areas should be sampled separately, as should any areas with marked differences in color, texture, or management. As a gross rule of thumb, a separate sample should be taken for every 4 to 6 hectares of land.

One soil sample actually consists of 15 to 20 subsamples of soil taken from the rooting zone of the crop being grown from representative locations throughout the field. The depth of the sample depends on the crop being grown. For most annual field crops, this is the plow layer or the top 15 centimeters (6 inches) of soil. This sample should be deeper for tree crops and other deep rooted perennial crops. The subsamples should be taken fairly evenly from throughout the field. However, if phosphorus fertilizer has been banded, compost heaps or manure piles or other unusual spots exist in the field, these areas should be avoided.

Sampling of rice paddies and similar wetland fields is the same as the process described above, except that the wetness of the soil poses additional problems in terms of collection, finding a suitable place to dry the sample, and in terms of the length of time it takes to dry and pulverize the sample.

The soil analysis results will also depend on the time of the year when the sample was taken, as the level of some nutrients, nitrogen in particular, does vary seasonally. For most purposes, you will probably want to take the sample just before a field is cropped. The level of drying will also affect the analysis results. Most laboratories recommend air drying samples in the shade before mixing, pulverizing, and screening the sample with a 2mm sieve or screen to remove any large clods, rocks, roots, or other debris.

Samples vary in size from one pound to several kilograms depending on the number and type of analysis to be performed. Most standard analysis should require no more than one kilogram of soil per sample. If no local, regional, or university soil laboratories are available which can conduct the analysis, you may have to ship the soil to another country. This will involve greater expense and usually, some paperwork. Soil samples entering the United States, for example, must be handled by the U.S. Plant Quarantine Service which will treat the samples at the point of entry by fumigating them with methyl bromide. This treatment will not change soil properties significantly.

Soil samples may be transported in cloth, paper, or plastic bags, or in special boxes or tins, depending on how they will be transported and the availability of containers. Whatever contained is used, a label or a piece of paper which includes where the sample was taken and other characteristics of the plot should be included with the sample. In fact, it is a good idea to keep such a label with the sample at all times, particularly when it is being dried and processed to avoid mixing up samples.

A note of warning: if the samples are analyzed in country, you may have to be patient. Problems with availability of chemicals needed in the analysis, instrument problems and repairs, and absence of trained personnel may all affect the speed with which the in country laboratory can complete soil analysis. In the Philippine study, it took the laboratory at a regional agricultural college from 4 to 6 months to analyze the soil from the time they received the samples.

If you do go to the trouble of taking soil samples and having them analyzed, it would be worthwhile to also request fertilizer recommendations based on the analysis for the benefit of the farmers who manage the plots you sampled and for the local agricultural extension office. This is especially true in areas where farmers are currently applying some form of fertilizer or lime to the soil.

For more information on soil sampling and related issues, see Pedro Sanchez (1976), *Properties and Management of Soils in the Tropics* (New York: John Wiley and Sons, pp. 295-345).

Appendix Table J.1 – Soil Sample Form

Plot No.:
Date:
Name of Farmer:
Location of Field:
Size of Field:
Topography:
Management:
Previous crops:
Crops to be grown:
Fertilizers/lime used:
Drainage and irrigation:

APPENDIX K

EXAMPLE OF TABLE USED FOR COLLECTING LABOR DATA, INDONESIAN STUDY

I.D. Code |___|___|___|___|___|___|

D.2 LABOR USE FOR SECONDARY CROP PRODUCTION

Land Area _ _ _ _ _ Crop of Crops (if intercropped) _ _ _ _ _ _ _

No.	Activity	Month	Family Labor												Non-Family Labor															
			Male			Female			Children			Animal			Male				Female				Children				Animal			
			No. Day	No. Ind.	Hour /Day	No. Day	No. Ind.	Hour /Day	No. Day	No. Ind.	Hour /Day	No. Day	No. Ind.	Hour /Day	No. Day	No. Ind.	Hour /Day	Wage* (Rp)	No. Day	No. Ind.	Hour /Day	Wage* (Rp)	No. Day	No. Ind.	Hour /Day	Wage* (Rp)	No. Day	No. Ind.	Hour /Day	Wage (Rp)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1.	LAND PREPARATION																													
1.1	Clearing																													
1.2	Plowing																													
1.3	Hoeing																													
1.4	Harrow																													
1.5	- - - -																													
	SUB-TOTAL 1																													
2.	SEEDING																													
3.	PLANTING																													
4.	SUB-TOTAL (2 + 3)																													
5.	WEEDING																													
5.1	I																													
5.2	II																													
5.3	III																													
6.	FERTILIZING																													
6.1	I																													
6.2	II																													
6.3	III																													

Explanations

1) Enter one Crop, according to the crops listed in table D.1, or enter 'intercropped'.

2) No. Day = Total Days Worked
No. Ind. = Total Workers per day
Hour/Day = Total Hours Worked

* DAILY WAGE LABOR : Wage = Cash + Value of Food received
GOTONG ROYONG : Wage = Value of food received
CONTRACT LABOR : Upah = Total cost per activity

APPENDIX L

EXAMPLE OF RECORDKEEPING SYSTEM FOR RECORDING LABOR DATA

Recordkeeping forms

Form 1 Family #_____ Labor Record (husband/wife)
Month ____________ (Hrs. worked daily by task)
Activity: Date ____

Form 2 Family #_____ Plot Labor Record
Crop ______________________ Plot code _______
Date Activity # people # hours # hired wage w/food? other agreement

APPENDIX M

EXAMPLE OF FORM USED TO ENUMERATE HOUSEHOLD CREDIT

Date of Loan	Loan Amount		Source (Use Code)	Purpose of Loan (Use Code)	Colla-teral (Use Code)	Date of Repay-ment	Interest Rate (%)	Amt. Already Repaid		Amount Outstand-ing
	Cash	Goods						Cash	Goods	

SOURCE CODE

1 = credit coop
2 = agricultural bank
3 = supply/marketing coop
4 = other government agency
5 = private financial institutions
6 = relative
7 = friend
8 = fellow villager
9 = someone outside of village
10 = township or village enterprise
11 = other: ________________

LOAN OBJECTIVE CODE

1 = short-term production loan
2 = longer-term production loan
3 = land improvement (including irrigation)
4 = cottage industry development
5 = commerce/trade
6 = agricultural equipment
7 = draft animal
8 = transportation vehicle (boat)
9 = house construction
10 = consumption
11 = marriage, funeral, sickness
12 = tuition
13 = other: ________________

COLLATERAL CODE

0 = none required
1 = land contract
2 = agri. goods (stored grain)
3 = agricultural equipment
4 = house
5 = durable good
6 = guarantor
7 = other: ________________

APPENDIX N

EXAMPLE OF TABLE FOR COLLECTING INFORMATION ON OWN-CAPITAL ASSETS

6.1 Please fill in table on your household's farm capital assets:

Tool Type	Quantity Purchased	Your Family's Share (Fraction)	Purchase Price (Yuan)	Length of Ownership Through Present (Years)	Estimated Length of Remaining Useful Life (Years)
Plows					
Wide-Tooth Harrow (chao)					
Narrow-Tooth Harrow (ba)					
Paddle Wheel					
Tractor					
Water Buffalo					
Back-pack sprayer					
Hand-cart					
Pump					
Other Irrigation Equipment					
Threshing Machine					
Boat					

APPENDIX O

EXAMPLE OF TABLE FOR COLLECTING DATA ON USE OF OWN-CAPITAL

6.2 Use of ag-machinery by crop this season (this includes only equipment owned by farmer and operated by farmer for cropping activities)

Tool Type	Wheat (Hours) DJ-71	Rape (Hours) DJ-72	Barley (Hours) DJ-73	Other winter crops (Hours) DJ-	Perennials (Hours)
Plow					
Wide-Tooth Harrow (chao)					
Narrow-Tooth Harrow (ba)					
Paddle Wheel					
Tractor					
Water Buffalo					
Back-Pack Sprayer					
Hand-Cart					
Pump					
Other Irrigation Facilities					
Threshing Machine					
Boat					

DJ-84: bread bran
DJ-85: green manure
DJ-89: other:
specify:

QT-52: mint
QT-53: mulberry
OC-64: lotus
OC-66.6: ramid

APPENDIX P

EXAMPLE OF TABLE FOR COLLECTING DATA ON CURRENT INPUTS – FERTILIZER QUANTITY

This table asks the quantity of each type of fertilizer that is applied to the different crops:

Crop	Fertilizer Type					
	Urea=1	ABC=2	Phosphate=4	Type:	Type:	Type:
Wheat DJ-71						
Rape seed DJ-72						
Barley DJ-78						
Other Winter Crop DJ-						
Perennials						

Chemical Fertilizer Type Code:
1 = Urea
2 = ABC
3 = Ammonia Water
4 = Phosphate
5 = Potash
6 = Compound
7 = Other 1
8 = Other 2

Other Winter Crop Code:
DJ-84: QT-52:
DJ-85: QT-53:
DJ-89: OC-64:
OC-66.6:

APPENDIX Q

EXAMPLE OF TABLE FOR COLLECTING DATA ON CURRENT INPUTS – FERTILIZER

Price Category	Prices by fertilizer type; source of purchase								
	Area			ABC			Phosphate		
	Price	Amount	Source (use code)	Price	Amount	Source (use code)	Price	Amount	Source (use code)
Quota Price									
Negotiated Price									
Other Price									

Price Category	Prices by fertilizer type; source of purchase								
	Other fertilizer Type 1			Other fertilizer Type 2			Other fertilizer Type 3		
Quota price									
negotiated price									
other price									

Fertilizer Type Code:
1 =
2 =
3 =
4 =
5 =
6 =
7 =
8 =

Source of Purchase Code:
1 = State supply/Market Corporation
2 = Free market
3 = Other private parties
4 = Directly from the fertilizer factory
5 = Other: ____________ (specify)

APPENDIX R

EXAMPLE OF TABLE FOR COLLECTING DATA ON CURRENT INPUTS – INSECTICIDES AND HERBICIDES EXPENDITURES

4.5 Did you apply insecticides this season?

|___| No (go to 4.6) |___| Yes (continue)

Crop	Expenditure (Yuan)	Reason for applying
Wheat DJ-71		
Rape seed DJ-72		
Barley DJ-73		
DJ-Other Winter		
Perennials		

4.6 Did you use herbicides this season?

|___| No (go to 4.9) |___| Yes (continue)

Crop	Expenditure
Wheat DJ-71	
Rape DJ-72	
Barley DJ-73	
Other Winter DJ-	
Perennial	

DJ-84: QT-52:
DJ-85: QT-53:
DJ-89: OC-53:
OC-66.6:

APPENDIX S

EXAMPLE OF FORM FOR ELICITING QUANTITY AND EXPENDITURES OF FARM INPUTS USING ABBREVIATED PRODUCTION FUNCTION APPROACH

Field ID: ¦__¦ Name of field: Field Area ¦__.____¦ he.

A. Principal Operators: (1) ¦__¦__¦ ________________ (2) ¦__¦__¦________________

B. Field is a: ¦__¦ MUNDA ¦__¦ DIMBA (check one)

C. List crops planted/to be planted in this field, dates, and seed information below.

D. Have fertilizers been applied in this field? YES NO

(1) 20:20:0 ¦___.___¦ bags K¦___.___¦ per bag FC

(2) CAN ¦___.___¦ bags K¦___.___¦ per bag FC

(3) Urea ¦___.___¦ bags K¦___.___¦ per bag FC

E. Have chemicals been used? YES NO

(1) Dimethoate ¦___¦ pkt K¦___.___¦/pkt

(2) Others: ¦___¦ pkt K¦___.___¦

PLOT NO.	GENERAL DESCRIPTION	WHAT PORTION OF THE FIELD	SIZE CODE
0	(the whole field)	(the whole field)	
1			¦__¦
2			¦__¦
3			¦__¦
4			¦__¦

EXPENDITURES - ONE MONTH RECALL

Cash or in-kind?	What did you spend money for or why did you give goods?	Expend. Code	Where was the expenditure made (or to whom)?	Code	Amount	Units	Price per unit	Total Value
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦
C X		¦__¦__¦__¦		¦__¦__¦		¦__¦__¦		K¦_¦_¦_¦.¦_¦_¦

APPENDIX T

EXAMPLE OF TABLE FOR COLLECTING INFORMATION ON MARKETING TRANSACTION COSTS

9.17 Have you sold grain on free market since last year?

|______| yes = 1
no = 2

If yes, continue; if no, go to 9.18

9.17.1. Fill in the following table regarding free market sales:

	What Market (use code)	How much did you sell (jin)	Distance to market (minutes)	Transport method (use code)	No. of times to each market (times)	Transport fee (yuan)	Other expenses (Yuan)
1							
2							
3							
4							

Market Code

1 = take grain myself to free market in township
2 = take grain myself to free market out of township, within county
3 = take grain myself to free market out of county
4 = hire someone to take grain to market
5 = sold grain to other farmer in village
6 = sold grain to buyers who came to village
7 = sold grain retail in free market
8 = other:______________________

Transport Code

1 = walking
2 = by bicycle
3 = by boat
4 = with hand-drawn cart
5 = with animal-drawn cart
6 = by tractor
7 = by truck
8 = other:______________

APPENDIX U

COMPARISONS OF SURVEY AND RECORDKEEPING DATA COLLECTION METHODOLOGIES FOR PRODUCTION DATA

	Survey Method	Recordkeeping
Research Time	Moderate	High
Respondent Time	Moderate	High
Accuracy of Data	Moderate	High
Manageable Sample Size	Large	Small
Ability to Collect Continuous Harvest Data	Difficult	Easy
Training Time	Lower	Higher
Overall Cost	Lower	Higher

REFERENCES

Ariza-Nino, Edgar J. 1982. "On-site Computation of Farm Plot Areas." In *Consumption Effects of Agricultural Policies: Cameroon and Senegal.* Prepared by CRED/University of Michigan, USAID Contract DSAN-C-0270.

Buck, John L. 1937. *Land Utilization in China.* Nanjing: University of Nanjing Press.

Casley, D. J., and D. A. Lury. 1987. *Data Collection in Developing Countries.* Oxford: Clarendon Press.

Dick, Ruth. 1989. *Accounting for the Effects of Irrigation in Farm Production Data.* Working Paper Series. Ithaca, NY: Department of Rural Sociology, Cornell University.

Food and Agriculture Organization. 1960. *Technical Conversion Rates for Agricultural Commodities.* Rome: FAO.

Herdt, R. W., and A. M. Mandac. 1981. "Modern Technology and Economic Efficiency of Philippine Rice Farms." *Economic Development and Cultural Change.* 29: 374-399.

Hunt, K. E. 1969. *Agricultural Statistics for Developing Countries.* Oxford: University of Oxford Institute of Agrarian Reform.

Norman, D. W. 1973. *Methodology and Problems of Farm Management Investigations: Experiences from Northern Nigeria.* African Rural Employment Paper No. 8. African Rural Employment Study. East Lansing, MI: Department of Agricultural Economics, Michigan State University.

Scott, Gregory J. 1991. *White-Collar Fieldwork: Some Guidelines for Secondary Data Collection in Developing Countries.* The International Potato Center (CIP) Working Paper. Lima, Peru: CIP.

Shaner, W. W., P. F. Philipp, and W. R. Schmehl. 1982. *Farming Systems Research and Development: Guidelines for Developing Countries.* Boulder, CO: Westview Press.

Spencer, Dunstan S. C. 1989. *Micro-level Farm Management and Production Economics Research Among Traditional African Farmers: Lessons from Sierra Leone.* African Rural Employment Paper No. 3, African Rural Employment Study. East Lansing, MI: Department of Agricultural Economics, Michigan State University.

Tumari, I. 1989. "The Effect of New Technology on Land Prices in Indonesia." Presented at third DIS conference in Dacca, Bangladesh.

Verma, V., T. Marchant, and C. Scott. 1988. *Evaluation of Crop-Cut Methods and Farmer Reports for Estimating Crop Production: Study in Five African Countries*. London: Longacre Agricultural Development Centre Limited.

Wood, G. D., and J. A. Knight. 1985. *The Collection of Price Data for Measurement of Living Standards*. Living Standards Measurement Survey Working Paper No. 21. Washington, DC: World Bank.

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