AGRICULTURE AND RURAL PROBLEMS

I THE ROLE OF CASE STUDIES IN FARMING SYSTEMS RESEARCH

II HEALTH, NUTRITION AND AGRICULTURE: LINKAGES IN FARMING SYSTEMS RESEARCH

by

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Paper I discusses the case study method as a useful and cost-effective addition to the range of research tools used in multidisciplinary farming systems research. The case study method provides information that would be hard to obtain by other means, as well as an opportunity for close collaboration between social scientists, natural scientists and farmers. Practical problems include selection and representativeness; data and data collection; analysis and reporting; and follow-up. These are discussed. The argument is illustrated with an example from Santa Cruz, Bolivia.

Paper II argues for the interdependence of health, nutrition and agriculture, and the implications this has for the content and method of farming systems research. The paper proposes a conceptual framework for analysing the linkages, and explores the implications for farming systems research in terms of data and procedure. A case study is presented, based on farming systems research in Santa Cruz, Bolivia. It is concluded that this is potentially a very productive area in which further research is needed.

Paper I

The role of case studies in farming systems research

Contents

1. INTRODUCTION[1]

The research procedure used by social scientists in farming systems research (fsr) is on its way to being graven in stone, largely as a result of the pioneering, successful and widely disseminated work of the economists at CIMMYT.[2] However, before the tablets are carried down from the mountain, there may be time to enter a dissenting voice and argue for the use of a tool that will otherwise be excluded: the case study. The argument rests not only on the intrinsic merits of the case study method, particularly where researchers are concerned not with one crop but with a whole range of enterprises; but also on a belief that too much stress has been laid on diagnostic work in the development of fsr procedures. The use of a case study method is therefore recommended in the context of an fsr procedure that is continuous and longer term than is sometimes advocated elsewhere.

Although fsr methods are presented as being iterative and continuous, with a strong component of evaluation and feed-back, most of the work on the development of appropriate research tools has concentrated on the diagnostic stage: that is to say, the main concern has been to assemble and analyse information about the characteristics of farming systems in a study area. This is used to permit farms to be classified into relatively homogeneous recommendation domains and then 'diagnosed', so that limiting factors and opportunities can be identified. The information required for this purpose is very broad, ranging from background data about the natural and socioeconomic environment in which farms are located to very detailed descriptions of the agronomic practices undertaken with respect to particular crops. An idea of the complexity of the task can be obtained by studying the various checklists produced as a guide to field workers, for example by Collinson (1981), Byerlee, Collinson et al (1980), and Shaner et al (1981). Maxwell (1984) has stressed that farming systems are constantly changing and that the time dimension is therefore also important in fsr.

The business of collecting and analysing all this information presents a number of characteristics peculiar to fsr. In the first place, the task both has and ought to be multidisciplinary, involving natural scientists as well as social scientists. It has to be multidisciplinary because social scientists on their own are usually unable to accumulate and make sense of data on such aspects as climate, soils and pest ecology. More important, the task ought to be multidisciplinary because the results of the diagnostic stage will have major implications for the determination of research priorities and the allocation of research resources among disciplines: the involvement of all disciplines in the collection and analysis of diagnostic data will help to reduce conflict and build a consensus around research reorientation.[3]

A second characteristic of data collection for diagnostic purposes is that it is heavily time-constrained. This is partly because data are genuinely needed in a hurry if research decisions are to be influenced; but also because social science studies of rural environments are often unpopular, seen as a diversion of scarce resource funds and as a threat to established research programmes. The social scientist engaged in diagnostic work is often a new appointment to research stations, frequently feels under pressure, and sees a need to establish credibility by producing quick results. At the same time, resources are limited so that a third characteristic of diagnostic studies is that they are constrained by a shortage of cash, especially for costs over and above those of professional staff: funds for enumerators, petrol, paper, clerks or computer time will all be short, especially in national research systems far removed from the well-funded glamour of the CGIAR international centres.

In response to these needs, CIMMYT economists and others have focused on a three step procedure, which draws heavily on methods of Rapid Rural Appraisal (RRA) but provides also the more rigorous analysis needed to ensure credibility.[4] The three steps are:

(i) assembling background information, mainly by drawing on published and unpublished secondary sources;
(ii) an exploratory survey, relying on informal RRA techniques to obtain information from a wide range of informants, including input suppliers, merchants and bankers as well as farmers;
(iii) a formal survey, using statistical sampling techniques and structured questionnaires in order to produce data for more rigorous analysis (Byerlee et al 1980).

There are variants on this, different names are given to the different stages and different ways are suggested of organising the work. Hildebrand's structured 'sondeo', for example, is a method of carrying out an exploratory survey in a week by using a multidisciplinary team working in small groups (Hildebrand 1981); it has been used elsewhere with mixed results (Lawrence-Jones 1983). Others have recommended abandonment of the formal survey if results from the exploratory survey are adequate (Galt et al, 1982). The emphasis is very often on speed: CIMMYT suggest 12 weeks from start to finish (Byerlee, Collinson et al 1980:23) and, more recently, Collinson, based on his experience in East Africa, has suggested that diagnostic work can be completed in only two to three months (Collinson 1982).

The impact of these methodological advances should not be underestimated: they have contributed to a significant strengthening of the link between the particular problems of particular groups of farmers and the research designed to help them. However, there is a case for complementary methods to be considered, as we now proceed to argue.

2. THE ROLE OF CASE STUDIES IN FSR

The case study method is a familiar tool in many branches of science. The medical 'case' is both an object of study in its own right and a means of illuminating a broader problem area; the management 'case' serves the same purpose in a training context. In the social sciences, the case approach is characteristic of much research where shortage of time or resources limits the coverage of a particular investigation: the village study is a good example (Lipton and Moore 1972). There has recently been a good deal of interest in case studies as a tool in monitoring and evaluation studies and Casley and Lury (1982:62) provide a helpful general definition of a case study as: 'the detailed study of a small number of units, selected as representative of the group or groups relevant to the issue under consideration, but not necessarily representative of the population as a whole'.

As they note elsewhere, 'the essential methodological feature ... is that (the case study) provides in-depth, detailed analysis (of relatively few cases)' (Casley and Lury 1981:62). Case studies can play an important part in the rural research tool-box. It is worth pausing to examine the general argument before turning to the contribution of case studies in fsr.

(a) The argument for case studies

The general argument for case studies begins by noting that there are different kinds of data and that there is a range of alternative research techniques to acquire data; it then proceeds to develop criteria by which techniques can be matched to data and concludes that the case study is an appropriate technique for certain purposes. The steps are set out in more detail below, building on the framework provided by Casley and Lury (1981, 1982).

Data can be classified in a number of different ways: as quantitative or qualitative; objective or subjective; macro or micro; sensitive or not; formal or informal; widely distributed or rare; easy or difficult to measure. The classifications apply across sectors and produce bits of information that are very different one from another. Information about the wholesale price of herbicide, for example, is quantitative, objective, macro, not particularly sensitive and easy to measure. On the other hand, information about farmers' risk aversion may be at the opposite end of the spectrum on almost all counts. Furthermore, information about herbicide prices is likely to be recorded and to some extent in the public domain, whereas information about risk aversion is neither. It is obvious that the same research tool cannot be used to investigate both.

There is, however, a range of research tools available. Five main classes may be distinguished: secondary sources; rapid

rural appraisal; surveys, both single visit and multiple visit; case studies; and experiments. These vary in cost, coverage, accuracy, time and statistical validity. Thus, a large, multiple visit survey is likely to be more scientific and more accurate as a representation of the population than a small, intensive case study, but it will also cost more and may take longer. There are therefore trade-offs to be calculated.

Since time and cost are the two main constraints, a research method should be chosen that provides the greatest speed and the lowest cost, subject to achieving required minimum levels of accuracy, coverage and statistical validity. So a study of herbicide prices could probably be conducted by reference to secondary sources or by means of a telephone survey of wholesalers; but an assessment of risk aversion might require intensive fieldwork of an anthropological or sociological kind. Of course, in practice, the data required will fall into several different categories: some will be easy or cheap to obtain and some will not. A combination or sequencing of research methods will then be needed.

Now, where do case studies fit into all this? Casley and Lury suggest that case studies may be particularly appropriate if (a) the phenomenon of interest is rare and clustered or found at specific sites, like villages; (b) the data to be collected require open-ended questions, attitudinal studies or unstructured interviews; (c) the observations and measurements to be made require technical skill or high levels of accuracy; and (d) continuous or frequent interviewing is necessary (Casley and Lury 1982:54). They add that case studies are a particularly good way to investigate causality (ibid:28); to investigate interrelationships between people; to establish and explain current attitudes and beliefs; and to show why certain behaviour occurs (ibid: 63). Chambers also argues for case studies to provide longitudinal data to illuminate change processes (Chambers 1983:118-21). There are other problems (discussed in more detail below), where case studies are appropriate because of the complexity or cost of data collection: much detailed farm management information falls into this category, including financial flows and labour profiles.

The argument for case studies can, then, be summarised in two propositions. First, there are some subjects for investigation or pieces of data, where intensive study of a few cases provides the only practical approach: quite simply, nothing else will work. Secondly, and perhaps more commonly, there are many other subjects where alternatives exist, but where case studies provide an optimal combination of time, cost, accuracy and coverage characteristics. In these instances, the case study is an appropriate substitute for or complement to other methods. It will have disadvantages, notably low coverage, but these are outweighed by the benefits.

(b) Case studies in farming systems research

If there is a general argument for case studies in rural research, it is appropriate to ask whether there is a role for case studies in fsr. To answer this question, it is necessary to return to the data requirements and to note that much of what needs to be known about the characteristics and evolution of farming systems in their natural and socioeconomic environment is of the kind that was identified above as being suitable for investigation by case studies. This is particularly the case when the effect on farming systems of social interrelationships is considered.

In the first place, there is a good deal of information which falls into the first category above, of being difficult to collect by any other method. In some cases, this is because the information is subjective or sensitive, like details of tenure arrangements or informal credit. In other cases, it is because the data required are unstructured, informal or difficult to record: this could arise in the context of using life histories to explore the evolution of farming systems; or, indeed, in the case of input-output studies where weights and measures vary from one household to another. An understanding of overall, management strategies presents similar problems. In yet another set of cases, case studies may strongly be preferred because a high degree of skill is required to collect data: for example, if complex crop associations or insect populations have to be studied.

Of course, many of these topics have been studied by other means, either in the context of exploratory surveys or in formal surveys. In many cases, doubt must be expressed about the quality of information obtained; in others, good information is obtained on a large scale by means of very expensive, multiple-visit surveys in which large numbers of field enumerators act effectively as individual case study investigators. The ICRISAT village studies in which enumerators were trained in insect recognition is possibly an example of the latter (Jodha, Ashoka and Ryan 1977). See also Hatch (1981) for a more decentralised but equally intensive approach in South America.

There are many other kinds of data where a case study approach is not necessary, but may be appropriate, especially in order to reduce costs or increase insight through personal contact. Many of the examples here can, and often have, been collected by multiple-visit surveys of long duration. They can, however, be obtained much more cheaply and perfectly adequately in case study programmes: cash flow data, labour profiles, seasonal nutrition patterns and harvest or post-harvest losses are all examples. The point in all these cases is that the extra cost of collecting and analysing data on a large scale in order to improve coverage and statistical reliability is unlikely to be justified by the extra benefits. Either very detailed data are not needed or it will take too

long to produce: a case study programme over the period, say, of a full agricultural year, can complement existing information in a cost-effective way.

These are general arguments for using case studies to collect farm-level data. There are three further arguments in support of using case studies in farming systems work. First, case studies both require and permit close contact between the principal investigators and the farmers. They require such contact because of the nature of the enquiry and the level of skill required; they permit such contact because the principal investigators are freed from the enormous administrative burden of supervising, transporting and administering field enumerators in large-scale surveys. A case study programme is a way of turning desk time into field time. This is particularly important in fsr because of the premium placed on understanding not only how a farm system works but also why it operates in the way it does. What farming systems researchers need above all is empathy and insight, both of which are obtained more effectively by visiting a small group of farms every week than by supervising large teams of enumerators. As Casley and Lury note: 'Case studies are particularly appropriate when a high analytical content is required' (1982: 63).

A related point is that case studies provide a much better context for multidisciplinary work than surveys. The social scientist is likely to be the coordinator in both cases. But in the case of a survey, natural science is likely to be restricted to the drafting of suitable questions and helping in the interpretation of results. In a case study programme, investigators of different disciplines can work side by side to collect data and develop their relationship with the farm family. These are the benefits of a sondeo extended over longer periods.

Finally, case studies are appropriate in fsr precisely because they provide longer term contact with farmers. The literature has focused on the need for quick diagnostic studies in order to provide diagnosis of constraints and opportunities. Even here, speed may be misleading if farming systems are changing very fast (Maxwell 1984). In addition, however contact with farmers is required at several other stages in the fsr process, notably when recommendations are being designed or begin to be adopted. FSR ought to be a much longer term process than is sometimes implied: case studies can make a very important contribution to consultation, monitoring and feed-back.

There is, then, a strong argument for using case studies as a research tool in fsr. Case studies will be non-random, multiple-objective, of mixed technique, multidisciplinary and of long duration, usually over a full agricultural year. They will not replace other research tools but will take their place in a sequence of investigations designed to improve

classification, diagnosis and the design of recommendations. They will take different forms depending on the circumstances, but a number of practical questions will arise in all cases. These are considered next.

3. PRACTICALITIES

Casley and Lury (1982) include a brief, general discussion on the practicalities of case studies, dealing with topic, timing, scale and subjects (pp 64ff). Attention here is focused on the particular problems of fsr with regard to (a) the selection and representativeness of farms; (b) the collection of data; (c) analysis and reporting; and (d) follow-up. It is assumed that in most situations, case study programmes will have fairly general objectives and that they will be concerned with the operation of the farm system in its totality; it is also assumed that they will continue for a minimum of a year, in order to cover the full agricultural cycle.

(a) Selection and representativeness

Representativeness is the single most important issue in case study programmes. It is an issue that has both substantive and political dimensions. Substantively, the researchers must be certain that if they select a small number of cases for a study, then the cases are representative of a particular groups in the population in their important characteristics: any general lessons they draw may otherwise be invalid. Chambers (1983) has laid particular stress on this problem in the context of investigator 'bias': spatial (urban, tarmac, raodside), project, person, dry season, diplomatic or professional biases may all lead to the selection of highly unrepresentative case study farms. Representativeness is also important politically if case study findings are to have any credibility: it is not just that cases should be representative, but that they should be seen to be representative. In other words, there should be a clear selction procedure whereby the characteristics of case study farms are related to the characteristics of the groups they represent.

Representativeness in fsr case study programmes is relatively easy to define, because of the role that classification plays in fsr. The basic concept underlying diagnosis and the generation of targeted recommendations is that of recommendation domains or homogeneous farm types. A single farm type will consist of farms with similar natural and socioeconomic characteristics, similar constraints and similar responses to new opportunities (Perrin et al 1976, Byerlee, Collinson et al 1980). Classification is a difficult and underresearched topic, but once a classification is available, then case study farms can be selected on the basis of known characteristics.

This conclusion has implications for the sequencing of research activities. Classification is sometimes based on the findings of informal reconnaissance but is more often the product of a formal survey. A case study programme could not then begin until a formal survey had been completed. This sequence has many advantages, not least that the survey findings can be used in support of the credibility of the selection of case study farms. But there may also be some disadvantages, if the classification is still unsure or if the findings of the case study programme itself generate changes in the classification. It should be remembered that fsr is always iterative.

The number of farms to be selected in each farm type will depend on the variability within the type, on the likelihood of drop-outs, on the range of data to be collected, on the number of farm types to be covered and on the capacity of the research team. A case study programme is unlikely to be the only preoccupation of investigators in a busy fsr team so their time may limit the size of the programme. What they can do in that time will depend on how long data collection takes and will be influenced by such factors as the accessibility of the study area and the availability of farmers. It should be remembered that the object of the exercise is not to produce a large amount of data for statistical analysis but rather to increase understanding of the farm system: in this case two farms in each farm type is probably a minimum and five is probably a maximum. This allows for the possibility of drop-outs but gives time for the intensive study required.

Whatever the number of farms in a particular category, case study programmes should have an overall limit of around ten. There are sharply diminishing returns to larger numbers because of less intensive or less frequent contact and sharply increased costs because of increased time for both data collection and data processing. A perfectly satisfactory case study programme, covering three or four farm types, can be run with between five and ten farms.

If representativeness is a concern in selecting farms, then great care should be taken to ensure that the farms remain representative over the course of the programme. In particular, the investigators themselves should not alter the characteristics of the farm by providing substantial advice, inputs, loans or services to the farm. This can be extremely difficult, not least because small gifts, help with transport, shopping in town or advice on agricultural problems help to ensure cooperation and form part of a friendly relationship. Clearly an intensive case study programme will have some influence on farms, but major effects should be avoided: for example, on-farm trials should not be located on case study farms unless they are very widespread in the study area.

Finally, these remarks imply the need to monitor representativeness over the life of the research programme. Explicit validation should be undertaken of the continuing representativeness of case study farms: this may simply involve visiting other villages or farms in the area occasionally, but may require more formal work. The case study programme should not be allowed to induce myopia in the investigators.

(b) Data and data collection

It is necessary to decide what data to collect and how often to collect them. These questions are not independent, of course, since farmer recall varies for different items and physical recording must be done at different intervals for different purposes. It is therefore necessary to begin with data requirements, physical, biological and socioeconomic, both inside the farming system and outside it.

There are two schools of thought on data collection in case study programmes. On one side are those who believe that specific hypotheses should be tested in such a programme and that data should be collected only to make such tests possible. On the other side are those who argue that a case study provides an opportunity to describe farm systems as completely as possible so that everything available should be observed, weighed or measured.

Each of these positions presents difficulties. The minimalist position requires a great deal of preliminary analysis and reduces the opportunity to open new areas of investigation during the year. The maximalist path may impose such a weight of data collection that farmers become burdened by the programme and investigators lose themselves in data. It may therefore be appropriate to pursue a middle path in which a minimum of data is collected for overall description and analysis; one or two special studies are pursued; and the programme is allowed to develop if new areas become important during the year. Often the most important aspect of a case study will not be the formal data collected but the understanding of management practices derived from conversations with the farmer.

If these precepts are accepted, then the minimum output of a case study programme (excluding special studies and detailed agronomic data) might be as follows:

1. A physical description of each farm, including a summary of climate (from secondary sources), soil, topography, physical access and a map of land use during the year.

2. A socioeconomic description of each farm family, including outside relationships, position in the village, family

size and composition and other relevant factors like food preferences or health and nutrition status at different times of the year.

3. An account of the state of the farm at the beginning of the year and of activities during the year, based on the land use maps and on
   (a) a balance sheet for the beginning and end of the year;
   (b) a profit and loss account for the year;
   (c) a statement of cash flow for the year; and
   (d) a summary of family labur use for the year.

4. An analysis of developments during the year, focusing especially on the binding constraints and on the farmer's management strategy.

The instruments required to gather these data are listed in table 1: there are six essential items and a further three which may be necessary or which may provide more detailed information. The procedure is to describe the farm as fully as possible at the beginning of the study, by means of a sketch map, a summary of household composition and a detailed farm inventory; then to follow the progress of the farm over a full year, usually at weekly or ten-day intervals, depending on the quality of recall and level of detail required; and finally, to describe the farm again at the end of the year.

Most of the instruments listed are standard farm management tools and are described in textbooks.[5] A few comments may, however, be in order:

(i) The maps need not be very accurate but should identify individual fields and the crops grown on them. Field size should be estimated by using a measuring wheel or by pacing, in combination with a compass to take bearings. It is much easier to do this when the field is empty. If there is more than one growing season, it may be useful to make a map at the beginning of each season.

(ii) The household composition schedule should list all household members and should be updated as needed, for births, deaths, migrations or visitors. The main activities of each member should be listed.

(iii) The farm inventory should cover land and land improvements; buildings, machinery and equipment; livestock; and working capital, including items in store, standing crops (including trees), tillage and cash. Financial valuations and rates of depreciation are required for the balance sheet. Some of these items may be sensitive, such as the amount of food in store or cash in hand, and it may be necessary to estimate these on the basis of transactions during the year.

Table 1 List of instruments used in fsr case study programmes

No.	Title	Frequency	Total No.	Comments
A. Essential				
1.	Map	Beginning and end of year	2	To show access infrastructure, and land use. Soil details may be added.
2.	Household composition schedule	Beginning of year, updated as needed	1	To how main activities of all household members.
3.	Farm inventory	Beginning and end of year	2	To identify and value all items of fixed and working capital.
4.	Cash flow record	Every 7-10 days	36-52	To include all cash transactions, including non-agricultural.
5.	Family labour use record	Every 7-10 days	36-52	To identify main activities of all economically active household members.
6.	Diary of events	Every 7-10 days	36-52	Brief, analytical account of farm and off-farm activities and record of discussion on management questions.
		Sub-total	113-161	
B. Additional				
7.	Field register	Every 7-10 days	36-52	To record quantitative and financial input-output data at the field level.
8.	Non cash transactions record	Every 7-10 days	36-52	To record payments in kind, reciprocal labour, major gifts.
9.	Domestic consumption record	Every 7-10 days	36-52	To record amount and composition of food intake, including that purchased.
		Sub-total	108-156	
		Grand total	221-317	

(iv) The cash flow record should record all receipts and payments on a daily basis over the year. The recording interval will depend on the quality of recall and it may be that longer intervals than those recommended will still produce adequate data; it may also be possible to experiment with self-recording by farmers. At a minimum, all agricultural transactions should be included; but it is useful also to record non-agricultural transactions, including domestic purchases. It is not necessary to have a detailed coding system set out at the beginning of the study, but space on the form should be left for this purpose.

(v) The family labour use record can be approached in different ways, depending on the precise objective. If the objective is to identify busy periods and the main activities carried out, then it will be sufficient simply to record the main activity carried out in each half-day period by different individuals. If, however, more detailed information is needed (but what for?) then hourly data may be required on tasks carried out: in this case the interview interval will have to shorten considerably. A decision will also have to be taken about whom to include: although on principle all household members should be covered, time allocation interviews are very time-consuming and it may be necessary to interview only household members who do a substantial amount of agricultural work.[6]

(vi) The diary of events is probably the most important record of the case study. It provides an informal report of discussion and observations and complements formal data collection. It should be completed after every visit and observations should be solicited from all members of the research team who visit the farm. The diary should include reports on the state of crop and livestock enterprises, including observations on such matter as establishment, weed and pest problems and harvest or post-harvest operations.

(vii) A field register will provide an input-output record for each field on the farm; in particular, it will show labour and input use and record yield. It may also be used to record agonomic information such as plant density or pest and weed population. The trouble with field registers is that they add enormously to the time taken in data collection and to the volume of paperwork. They increase the risk of farmer fatigue. There will be some cases in which field registers may be necessary: for example, they are a useful device for monitoring the use of hired labour in circumstances where there is a long time lag between work being carried out and being paid for. In this event, the field register is needed in order to construct an overall profile of farm labour use. Similarly, field

registers may be necessary in cases where complex patterns of inter-cropping or sequential cropping make it difficult to assess yields. However, in other cases, the main value of field registers is that they provide information needed to compile crop budgets. This is probably not a good idea if crop budgets can be estimated another way (often from secondary sources): inter-farm variability is likely to be significant and the extra costs of yield measurement and interview time will be high.[7]

(viii) Non-cash transactions may need to be recorded if reciprocal labour or payments in kind are important phenomena and affect the profit and loss account. Such transactions need to be valued. If they occur on a minor scale then they may be entered as notes to the cash flow and family labour use records.

(ix) Finally, domestic consumption may need to be recorded for various purposes: it features in the profit and loss account and is a component of any analysis involving health or nutrition status. It may, however, be possible to estimate these items or use informal data collection techniques. For example, recording information from conversations in the farm diary may be as helpful as trying to run a full dietary survey.

Clearly, there are items missing from this list.[8] The amount of physical recording, for example of crops in store, is kept to a minimum; detailed accounts are not kept of machinery or draught animal utilisation; and there is very little recording of unpaid non-agricultural work, especially by women. Nevertheless, the data collection effort is substantial: over a hundred 'interview-events' during the course of a year even without using field registers or other non-essential schedules. It may be that farmers can be persuaded to do this, and more, though the difficulty of carrying out interviews during peak labour periods should not be underestimated. But apart from these problems on the supply side, there are also problems on the demand side with the amount of time the investigators have for collection and analysis. The more data that investigators try to collect the more necessary it will be for them to formalise the procedure, the greater will be the temptation to use enumerators and the greater will be the danger that informal conversations between farmers and investigators will be sacrificed. There is therefore a strong incentive to keep data collection simple. It is worth reiterating that the informal diary is the most important single instrument.

The list of essential instruments provides a programme that can be carried out in about an hour once a week or once every ten days; adding field schedules would probably double this in most cases. When travelling time to the study area and between farms is added, along with related fieldwork in the

study area, a case study programme of between five and ten farms can be expected to take the principal investigators one to two days per week for a year in data collection alone. This is a substantial commitment but one that can show a high return if analysis and reporting are carried out quickly and effectively. To this we now turn.

(c) Analysis and reporting

There are three problems associated with the analysis and reporting of case study data. The first is that the data will be both formal, derived from survey instruments, and informal, derived from conversations with the farmer or observation of the farm. Although both raise problems of credibility, for reasons discussed above, the problem is particularly acute in the case of informal data. A way therefore has to be found in which data can be presented effectively so as to influence research decisions.

A second problem is that a case study programme begins to generate useful ideas very quickly after its initiation. Although much of the formal data cannot be analysed until a full year's data is available in the balance sheet and profit and loss account, much of the cash flow and labour use data can be of relevance immediately. Similarly, the informal data on management strategies can be of use in the short term. This is positively an advantage: quick results which have an impact on the research programme will help ensure continued support for the programme.

A third problem has to do with the multidisciplinary content of the case study programme. The social scientist, as noted, is likely to be the prime mover and the principal investigator. However, other disciplines will be involved in both formal and informal data collection: apart from visiting the farm in an informal way, natural scientists may wish to use case study farms for studies for their own purposes. A way should be found to integrate all these research findings and make the analysis truly interdisciplinary.

These three problems together make it unlikely that a single report, prepared by the social scientist at the end of the year, will be a sufficient output from a case study programme. Such a report is necessary, and should draw on the farm accounts as well as the observations made during the year, but in addition, the following might be considered:

(i) Monthly or quarterly reports, summarising the information to date and drawing out implications for the research programme. These might contain sections written by various disciplines.

(ii) Regular seminars to discuss progress with the programme, perhaps with the lead being taken by a different disciplinary specialist on each occasion.

(iii) On-site visits by multidisciplinary groups at regular intervals with joint reports prepared after each visit (a kind of accelerated and repeatable 'sondeo').

(iv) Meetings with farmers' associations, based on case study findings and relating these to research priorities or outputs.

(v) A regular newsletter for research staff, to report on events in the case study area.

The general thrust of all these suggestions is to break down the idea of a formal, independent research programme and build up the idea of a dynamic, multidisciplinary interaction with farming communities. A case study programme provides a way of focusing this learning process and may give farmers a greater voice in the research process than they would otherwise have.

In all this analysis, it is important to remember that case study farms have been selected purposively and non-randomly. They are also few in number. The temptation to aggregate, average or analyse statistically should therefore be resisted. Case study data are suitable for in depth, longitudinal analysis and not for cross-sectional comparisons. To emphasise this, it is worth preparing individual reports on each case study farm before drawing up an overall summary. The individuality of each case should be emphasised, despite the intention that these individuals should be representative.

(d) Follow-up

It has been suggested that case studies are an effective way to generate information about what is happening on farms and that they can begin to do this very quickly. This information can influence the research programme not only at the diagnostic stage, where problems are identified and resources allocated, but also at the stages where recommendations are made and implementation encouraged. New information, derived from the case study programme, about the precise pattern of cash flow or labour use, may, for example, affect the opportunity cost values used in partial budgeting of input use. A case study programme will be particularly strong in demonstrating the relationship between enterprises: it adds a farm management dimension to the more agronomically-based research methods. It is very important that the results of the case study programme be incorporated in this way into the managerial decision-taking process of an fsr programme.

Like most pieces of research, however, a case-study programme will inevitably generate further questions for research. Again, it may become apparent very early on that unsuspected problem areas exist and that these will require more intensive study than can be provided by the case study programme itself. This may be because the resources available may be insufficient to study the problem even on the particular

farms: for example, sampling of grain stores may be required at more frequent intervals than allowed by the existing programme of visits. Alternatively, the problem may arise because an aspect of interest on one farm may need to be studied on a bigger sample of farms in order to be sure that it is a problem affecting all farmers: is it just the case study farmer who suffers from water-logging, for example, or is this a widespread phenomenon?

In both these cases, separate, complementary studies will be required, needing separate funding and resources. It may be possible to plan for a small number of unspecified studies as part of the case study programme; or additional funding may have to be secured. The point, however, is that the case study is not an end in itself. It contributes to a continuous programme of study which uses different tools and different levels of aggregation or disaggregation.

4. AN EXAMPLE: SIX FARMS IN SANTA CRUZ, BOLIVIA

(a) Background

This section contains a brief account of a case study programme carried out in 1980-81 as part of an fsr programme in Eastern Bolivia. The account focuses on method and uses the results obtained primarily to illustrate methodological points. Full details of the programme and of the results can be found elsewhere (Maxwell, Stutley and Bojanic 1982 - hereafter MSB).

The fsr programme was concerned with farmers in colonisation areas on the edge of the Amazon basin, in a total catchment some 150 km square to the north of the city of Santa Cruz. Around 15,000 families had settled in this area over a period of 20 years, on plots originally covered in primary forest and typically of 20-50 ha in size. Over time, an evolutionary process could be discerned in which farmers began by clearing the forest on a slash and burn basis at a rate of two to five ha per year, obtaining high yields of upland rice with relatively little labour input apart from clearing and harvesting. When the primary forest was exhausted, farmers would return to secondary regrowth or 'barbecho', obtaining much lower yields with a much higher labour input, especially for weeding: this was the 'barbecho crisis'. Some farmers had managed to escape the crisis by pursuing policies of destumping and mechanisation; livestock development; or planting permanent crops, especially banana. This process was associated with increasing social differentiation (Maxwell 1980a, 1980b).

FSR work began in the area in 1978 with detailed reconnaissance followed by a survey of 330 farms in 1979. This enabled a basic classification to be carried out, based on the descent into and escape from the barbecho crisis; and a

basic description of the farming systems to be assembled. It was suggested that high priority should be given in research to the process of transition from slash and burn to more stable agricultural systems; and that the strategies recommended should be low-cost, low-skill and low-risk in order to meet farmers' needs. The scarcity of labour and cash relative to land should also be recognised (Maxwell and Pozo 1981). At the same time, follow-up studies were recommended, particularly on harvest and post-harvest issues (Allen et al 1981, Maxwell 1982) and on labour use and cash flow.

The case study programme was designed to develop understanding of the farming systems in one particular colony, Chane-Piray, where it was hoped that World Bank funds for agricultural development would become available. Building on previous work, its objectives were:

(i) to establish in greater detail the characteristics of representative farming systems;
(ii) to assess the use of labour and cash resources over a full agricultural year; and
(iii) to evaluate farmer strategies and farm development possibilities (MSB:2).

(b) Selection and representativeness

Representativeness was assured by building on survey results in order to specify the characteristics of the farms to be included in the programme. A total of six farms was fixed for logistical reasons: essentially they would all be small farms of one or two plots (30-60 ha), at different stages of escape from the barbecho crisis. The farmers would be willing to participate in a year long study, but would not necessarily have to be literate; they would, however, have to speak Spanish (MSB:4).

The farms were selected by a two stage procedure. In stage one, a representative community was selected near the centre of the colony, named Faja in the report. In stage two, a census was carried out of the 57 farms in Faja and a sample of six was purposively selected. This work was spread over a period of two months, but could have been completed in two or three weeks of full time work. It was important, however, to visit a selection of areas in order to ensure that stage one was completed satisfactorily, and to spend time in Faja in stage two, explaining the programme and winning the support of community leaders.

The six farms in Faja were representative of the farms in Chane-Piray. Their characteristics at the beginning of the programme in October 1980 are summarised in Table 2. Three of the six had de-stumped land ('arado'), three had cattle and three had bananas. None had more than 60 ha altogether.

(c) Data and data collection

Data collection broadly corresponded to the pattern set out earlier, in the first part of Table 1. An initial resource survey was carried out and the farms were then visited at 7-10 day intervals, usually by two of the three principal investigators, all of whom were social scientists. Natural science colleagues participated in many of these visits. Data collection was particularly difficult because of poor communications and the scattered pattern of residence. A four wheel drive Land Rover was needed throughout the year and horses and wellington boots were essential additions for at least six months, because of heavy rainfall and floods. It was rarely possible to complete visits to the six farms in less than two full days of work.

Formal data collection concentrated on cash flow and on family labour use. Cash flow records captured all sales of crops and livestock as well as purchases of currrent and capital inputs, credit receipts and payments and non-farm or personal income and expenditure. With careful coding and analysis it provided most of the information needed for the profit and loss account.

The record of family labour use was simplified so that only the adult male was interviewed and he was only asked to name the major activity undertaken in each half day period. Women and children were excluded on the basis (justifiable in these six cases) that they played little part in direct agricultural work, except at harvest: to do otherwise would have increased the work load a great deal. It was decided also not to carry out detailed labour studies since good cost of production estimates were available from other sources and since more detailed data on this topic would have required more frequent visits.

The additional items listed in Table 1, namely field registers, records of non-cash transactions and domestic consumption records, were not maintained. Non-cash transactions were not numerous enough to warrant separate schedules, although there was some reciprocal labour and occasional payment in kind. Domestic consumption from on-farm sources was estimated from survey data in order to provide a notional entry in the profit and loss account. And field registers were tried but abandoned as too time-consuming to administer. This was probably a mistake: it proved difficult at the end of the study to draw up profiles of overall farm labour use. This was partly because people were often paid weeks after work was carried out (an important insight into cash flow management in its own right); and partly because payment was often made on a contract rate per hectare that made it difficult to reconstruct precise labour inputs.

Because there were no field registers, formal records were not kept of agronomy or yield. However, these formed a part of

Table 2 Identification of Co-operating Farmers

Farm	Farm type	Farm characteristics (October 1980)					
		Farm size (ha)	Area de-stumped (ha)	Bananas (ha)	Cattle (AU)	Pigs (AU)	Family Labour (ME)
A	Basic barbecho	30	-	-	-	-	1
B	Diversified barbecho	48	-	1.5	2.4	2.5	1
C	Diversified livestock	60	-	-	9.4	10.5	1
D	Small arado	30	7	1.0	-	3.5	1
E	Small arado	30	5	-	-	12.0	1
F	Diversified arado	60	17	6.0	3.4	-	1

Source: MSB:5

informal data collection and were also studied on case study farms by natural science colleagues. Yield estimates were based on farmers' own estimates and correlated with sales, consumption and estimated changes in stock. It would probably have been desirable to carry out simple crop-cuts, but these presented practical problems in slash and burn fields of high variability.

In addition to the formal data, of course, a great deal of informal data was collected, both on the six farms themselves, in Faja and more generally in the study area. This continual process of observation, investigation and validation was certainly the most useful part of the study, for which the formal data collection provided a justification.

(d) Analysis and reporting

Contrary to the advice given above, the main analysis was carried out after the end of the programme; nevertheless, some analysis was carried out during the year and one major follow-up study was initiated only a few weeks after the case study programme had begun. This is discussed below.

The main analysis, corresponding to the objectives of the programme, consisted of overall farm management analysis, supplemented by studies of labour use and cash flow (see MSB for full details). Table 3 contains a summary of the farm management data and Appendices 1 and 2 contain respectively summaries of the data collected on labour use and cash flow. The coding system used in these may be of particular interest.

As far as the overall summary is concerned, the picture confirms that land is not the scarce resource since no farmer used more than half the land available and five of the six used less than a third. However, what is particularly notable about the figures is that the extension of cropped area brought about by de-stumping was not associated with an increase in income: the gross margin earned on crops by farmer A, who had no land destumped, was higher than that earned by farmers D and E, who had around three times the area under cutivation; and only slightly below that earned by farmer F who had nearly six times the area under annual crops and spent twelve times as much on inputs. This was a very important finding, casting doubt on the whole development strategy being prepared for the area, which focused on de-stumping and mechanisation.

Many additional points emerged from the data on labour use and cash flow as well as from the informal observations made during the year. These included the following, all of which had implications for the research programme:

(i) Cash flow management was a major preoccupation for farmers. Enterprises cross-subsidised each other so that, for example, a farmer with pigs or bananas was

Case Study Programme, 1 October 1980 - 30 September 1981, Summary of Results

Item	A Basic barbecho	B Barbecho diversified	C Diversified livestock	D Small scale destumped	E Small scale destumped	F Diversified destumped
1. RESOURCES						
1.1 Land (has) Total	30	48	60	30	30	60
destumped		-	-	7	5	17
1.2 Labour (no.)	1	1	1	1	1	1
1.3 Capital (no.)						
lorry		-	-	-	-	0.5
tractor	-	-	-	-	-	0.5
spray	-	-	-	-	1	1
1.4 Livestock (A.U.)						
cattle		2.4	9.4	-	-	3.4
pigs		2.5	10.5	3.5	12	-
1.5 Net worth ($b)	84900	162850	277750	105500	92600	291400
2. ACTIVITIES (1980-81)						
2.1 Total area used (ha)	3.0	7.0	12.5	9.9	8.8	26.0
of which annual crops	3.0	4.0	4.6	8.9	8.0	17.0
2.2 Crops sown (ha)						
rice	2.5	3.0	3.8	4.3	3.0	6.0
maize	3.0	3.0	1.7	4.5	3.9	12.5
total	6.0	6.0	5.9	8.8	8.0	18.5
2.3 Bananas (ha)	m	1.5	-	1.0	-	5.0
2.4 Hired labour (no.)	55	208	154	218	139	350
2.5 Total cash exp. ($b)	8840	23443	20770	46257	50641	105343
3. INCOME ($b)						
Gross margin crops	17910	12760	6560	13591	1320	20213
Gross margin livestock	5010	16425	29825	6400	4804	20000
Farm profit	21720	27135	35485	20148	5204	87725

Source: Maxwell, Stutley, Bojanic (1982)

Note: $US 1 = $b25

more likely to buy herbicide for his rice or hire more labour for weeding. Returns to cash expenditure were very high, ranging from 12 to 259 per cent. Diversification had clear advantages (different enterprises were effectively complementary); and new technologies needed to offer very high rates of return to be competitive.

(ii) Farmers pursued a land extensive strategy, preferring to extend cropped area at low input levels rather than increase inputs to a smaller area. This was economically correct, since returns were thereby maximised to the scarce resources, labour and cash. Yield maximising strategies based upon 'good' management appeared, therefore, to be inappropriate.

(iii) Timing of winter crops presented problems since winter maize was not always out of the ground in time to plant summer rice. There was need for a programme of research to find a quicker-maturing variety of maize.

(iv) The summer rice harvest and post-harvest period was one of great stress for both labour and cash. This was an area neglected by traditional research that offered great potential for improvement in harvesting or threshing techniques.

Now, it is possible that all these observations could have been obtained from informal reconnaissance, by means of single-visit surveys or through large multiple-visit surveys. Indeed, some of the issues listed were identified at an earlier stage of fsr and further research was launched before the case study programme had even begun: the harvest and post harvest work is an example (Maxwell 1982). But the case study programme provided a combination of illumination and hard data that could not otherwise have been obtained in the same time or for the same cost; its small size made analysis relatively easy (not more than six or eight weeks work) and the continuous contact with a small group of farmers made for maximum understanding of system dynamics.

(e) Follow-up

Many of the findings listed above, and others summarised in MSB, had an immediate impact on the research programme. For example, a programme of on-farm trials designed to find a quicker-yielding variety of maize was launched in the winter of 1981. In addition, however, further research needs were identified: one of these in particular is worth noting.

It became apparent at the very beginning of the case study programme that farmers following the de-stumping route were in serious financial and technical difficulties, suffering from water-logging, insect problems, low yields and very poor financial returns. This was important because de-stumping

formed the backbone of the proposed World Bank project in the area. It was necessary to establish whether the problem was generalised to the whole of the project area or localised in Faja; and to establish whether or not the underlying problem could easily be remedied.

A separate study was therefore launched to look at these questions on a wider scale. A survey was carried out across the whole project area. It was concluded that the problem was indeed widespread for a certain class of farmers and that the underlying problem had to do with access to machinery and working capital. These problems could be overcome but, in fact, de-stumping offered a lower rate of return than other investments and should not be pursued (Stutley 1982).

This is, then, an example of a detailed case study contributing to the formulation of hypotheses requiring testing on a wider basis. The research process is continuous and does not end with a particular piece of empirical investigation.

5. CONCLUSION

This paper has argued that the case study can be a useful and cost-effective addition to the range of research tools used in farming systems research. Not only does it generate information and understanding that would be difficult to obtain by other means; but it also provides the opportunity for close collaboration between social scientists, natural scientists and farmers. It can contribute to individual professional development and to a stronger group dynamic. The paper has discussed the ways in which data collection can be organised and has provided examples of how case studies can contribute to the management of research and extension programmes. Most important of all, the paper has stressed that the case study is a way for investigators to develop close relationships with farmers and learn from them: the learning process should not be prejudiced by designing programmes that are over-ambitious in size or in the scope of data collection. The case study is a tool to be used by busy individuals who have other things to do as well.

It is in this context that the case study should be seen: as one tool among many with a particular contribution to make at a certain stage of fsr work. It is not a substitute for intensive, informal reconnaissance, nor for the wide-ranging survey which quantifies and legitimises the conclusions of RRA. Furthermore, the major findings of case study programmes will need to be validiated on a wider scale and will inevitably generate further research projects. However, case studies have a part to play in the progressive deepening of contact with rural families that characterises the best fsr: they can contribute especially to continuous, iterative research programmes.

It follows that case studies should be more widely used in fsr. Doubtless, their further use will produce methodological improvements and stronger guidelines. At the same time, it is important that the case study approach be introduced to natural-science fsr practitioners and to fsr managers: to the former so that they can be equipped to identify the need for case studies and carry them out; to the latter, so that they can be helped to understand the role of a research method that often seems imprecise and lacking in rigour. In practice, the case study method is neither of these things and deserves a place on the tablets of stone.

Notes

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2. See particularly Perrin et al (1976), Byerlee, Collinson et al (1980). Other key references are Norman (1980), Shaner et al (1981), IRRI (1984) and Zandstra et al (1981).

3. The question of disciplinary conflict in fsr is the subject of increasing attention. See, for example, Rhoades and Booth (1982), Biggs (1984), Horton (1983), Galt et al (1982).

4. On rapid rural appraisal, see especially Pearce and Jones (1981) Longhurst (1981).

5. See for example Yang (1965), Collinson (1972), Dillon and Hardaker (1980), and IRRI (1984). Binswanger and Jodha (1978) is a particularly useful source of reference.

6. The collection of labour data is problematical. A useful reference is Colema (1982). For an example of the effect of different recall periods see White (1984).

7. Examples of data collection instruments at the plot level can be found in IRRI (1984) and Zandstra et al (1981).

8. Compare this list, for example, with ICRISAT's much longer list in Jodha et al (1977), quoted in Dillon and Hardaker (1980:28-9).