A METHODOLOGICAL FRAMEWORK FOR COMBINING QUANTITATIVE AND QUALITATIVE SURVEY METHODS

Marsland N[1], Wilson I[2], Abeyasekera S[2], Kleih U[1]

An output from the DFID-funded Natural Resources Systems Programme (Socio-Economic Methodologies Component) project R7033 titled *Methodological Framework Integrating Qualitative and Quantitative Approaches for Socio-Economic Survey Work*

Collaborative project between the

Social and Economic Development Department, Natural Resources Institute

and the

Statistical Services Centre, The University of Reading

[1] Natural Resources Institute, University of Greenwich
[2] Statistical Services Centre, The University of Reading

A METHODOLOGICAL FRAMEWORK FOR COMBINING QUANTITATIVE AND QUALITATIVE SURVEY METHODS

Introduction

Qualitative survey methods started to gain prominence in development projects during the 1980s, primarily in response to the drawbacks of questionnaire type surveys, which were considered time-consuming, expensive, and not suitable for providing in-depth understanding of an issue (Chambers, 1983 and 1994; Pretty et al 1995). This led to a polarisation in collection and analysis of information with 'traditional', quantitative techniques on the one hand, and qualitative methods, on the other[3].

The result of this polarisation of approaches and the associated shortcomings was that the users of information were often dissatisfied with the quality of data and the resulting analytical conclusions. At the same time, it was recognised that there are areas/interfaces where the two types of approach can benefit from each other, leading in turn to improved quality of information which is required for intelligent decision-making at the various stages of RNR projects and programmes.

During the second half of the 1990s, attempts were made to highlight the complementarity of the two types of approach, e.g. in relation to poverty assessments in Africa (Carvalho and White, 1997; IDS , 1994). Other work e.g. Mukherjee (1995) examined the pros and cons of each type of approach and the potential for synergy in a general development context. In the field of renewable natural resources research it was realised that whilst some research practitioners were combining methods as a matter of course whilst conducting field research, experiences were often not documented. Moreover, several avenues of potential remained untapped. It was in this context that in 1997 the Socio-Economic Methodologies component of DFID's Natural Resources Systems Programme commissioned a three year research project "Methodological framework integrating qualitative and quantitative approaches for socio-economic survey work".

---

[3] This paper recognises that the terms "qualitative" and "quantitative" are not without potential problems. In their study of participation and combined methods in African poverty assessment, Booth et. al. (1998) make the distinction between "contextual" and "non-contextual" methods of *data collection* and between qualitative and quantitative *types of data* . Contextual data collection methods are those which "attempt to understand poverty dimensions within the social, cultural, economic and political environment of a locality" (Op. Cit. 54). Examples given include participatory assessments, ethnographic investigation, rapid assessments and longitudinal village studies. Non-contextual types of data collection are those that seek generalisability rather than specificity. Examples of these methods include: epidemiological surveys, household and health surveys and the qualitative module of the UNDP Core Welfare Indicators Questionnaire. The distinction between contextual and non-contextual is a useful one, and the current paper does not make this distinction explicitly. In practice however, this paper's use of the terms "qualitative *method*" and "informal *method*" correspond to Booth et. al's use of the term "contextual", insofar as these terms are applied in the context of the design and data collection stages of the information cycle (see Table 1). Similarly, this paper's use of the term "quantitative *method*" and "formal *method*" corresponds to Booth et. al's use of the term "non-contextual", insofar as these terms are applied in the context of the design and data collection stages of the information cycle (see Table 1). As Booth et. al. note however, contextual and non-contextual and qualitative / quantitative are best viewed as continua. There is no dividing line between what is contextual / qualitative / informal and what is non-contextual / quantitative / formal. This paper goes beyond the scope of Booth et. al. in that it examines *analytical* combinations as well. The meaning of the use of the terms qualitative and quantitative, formal and informal in the *analytical* context become clear on inspection of Table 2 and in the section entitled Type B: Sequencing.

This paper, which is an output of the above project, tries to offer practical guidance for field staff and project managers, allowing them to select the most appropriate data collection and analysis methods when faced with information *objectives* and *constraints* in the data collection and analysis process. The paper aims to address in general terms the basic question: "Given a set of information objectives on the one hand, and constraints such as time, money and expertise on the other, which combinations of qualitative and quantitative approaches will be optimal?" The guidelines are relevant for research involving both socio-economic data (e.g. livelihoods, wealth, gender) and natural scientific information (e.g. entomology, epidemiology). They are relevant for data collected within a "formal" setting as part of an experiment or a survey, and also in the context of participatory activities within a research or development context.

Practical Aspects of the Selection of Survey Techniques

In order to work out the most appropriate combinations of methods for a given task, it is necessary to consider both objectives and constraints.

Objectives: Investigation of a problem or phenomenon. This may be seen as the overall *goal* of data collection. Researchers need to decide:

- *What characteristics* (e.g. precision, scope of extrapolating from findings) the information ought to have.
- *For whom* is the information being collected? (e.g. project managers, policy makers, etc.).
- *Degree of participation:* In most (many) research activities there will be objectives which relate to *how* information is collected and analysed.
- *Training objectives:* There may be *training objectives* attached to the collection and analysis of information guiding the choice of methods.

Constraints. An important point to note in this context is that objectives interact with each other: having one objective will affect the extent to which other objectives can be achieved. In this sense, one objective can become a constraint to the achievement of another. This is because resources of time and money and expertise are limited. These resources will often shape the parameters of a fieldwork just as much as objectives.

Time: One of the reasons why informal methods came into greater use in the 1970s and 1980s was that practitioners and managers were fed up with the excessive time taken to conduct, analyse and disseminate sample surveys. Whilst in practice it is not possible to say *unequivocally* that participatory exercises are quicker than sample surveys - everything depends on the particular circumstances including expertise, logistics, and institutional constraints (see below for more details on these points) - it *does* appear that informal work is quicker than formal *more often than not*. Certainly, this is the - somewhat tentative - conclusion of Mukherjee (1995) who notes that "On balance...by and large...PRA method takes relatively less time".

In most project situations, time is at least as important as cost per day. For many project managers, the quicker turn-around time of informal work is a powerful argument for undertaking such work. It is important to compare like with like in terms of quality and quantity of coverage: a weak sample may be a false economy.

Cost: Received wisdom has it that sample surveys are expensive and PRA/ RRA type exercises are cheap. Gordon (1996), argues however that “there are certain “hidden” costs associated with informal surveys which should not be overlooked”.

Indeed, as Mukherjee (Op.Cit.) notes: “It is not easy to arrive at a relatively simple comparison of cost for the two methods [sample surveys and PRA]”. There are a host of factors to be considered in this regard which can influence both actual cost and imputed cost for undertaking conventional survey or PRA-type studies. As a consequence, it is not possible to say categorically that one type or collection of methods will automatically be more expensive than another type or collection, thus cost per se cannot be reliably used in a blueprint sense to select methods. Each case needs to be taken on its merits.

Expertise: As a general statement, informal survey work requires a greater array of skills per researcher than formal work, and formal work requires a greater number of people to undertake the research process. In addition, the need for a degree of multi-disciplinarity is greater in informal work, which derives much of its internal consistency from “triangulation” - including that achieved by the debate between investigators from different disciplines. For informal work, the interviewer normally will need to be highly skilled in interview techniques, and - often - to be familiar with a range of instruments. He or she will probably also be required to analyse the data at high speed, much of it in the field itself. Characteristically, in formal work a number of different individuals will be involved in the task of research design, training of enumerators, data collection, design of data entry programmes, analysis and write up.

Trustworthiness of information. The value of information depends on its trustworthiness. Here it is argued that the trustworthiness of information will be greater if quantitative and qualitative approaches to data collection and analysis are *combined* rather than being used separately. The following four tests of trustworthiness can be discerned:

- *Internal validity or Credibility*. The key question here is: How confident can we be about the “truth” of the findings?
- *External validity or Transferability*: Can we apply these findings to other contexts or with other groups of people?
- *Reliability or Dependability*: Would the findings be repeated if the inquiry were replicated with the same or similar subjects in the same or similar context?
- *Objectivity or Confirmability*: How can we be certain that the findings have been determined by the subjects and context of the inquiry, rather than the biases, motivations and perspectives of the investigators?

Internal and external validity, reliability and objectivity are the terms used in conventional scientific research. Credibility, transferability, dependability and confirmability are the terms put forward by Pretty (1993), after Lincoln and Guba (1985) to describe the equivalent criteria implicitly and routinely used in much participatory field research.

Obviously, the size of the target population has a bearing on the importance of these criteria for a particular study. For example, external validity plays less of a role if the target population is small (e.g. a small number of villages in the case of an NGO led development project). On the other hand, research projects covering entire regions or countries depend on results representative of these areas. Overall, formal work has probably most to gain from informal in the area of credibility and objectivity, whereas informal work (if it is to be generalised) can borrow from formal methods to improve external validity.

Types of Combinations. *Merging* is one way of combining qualitative and quantitative approaches. It consists of swapping tools and attitudes from one tradition to the other. In addition to *merging*, there are two other types of combining: *sequencing* and *concurrent* use of tools and attitudes. If they are to lead to integrated conclusions, sequenced and concurrent combinations should be followed by a *synthesis* of the information collected. Box 1 illustrates the differences between the different types of combinations with some examples.

Within a particular RNR research or development project dealing with the sustainability of livelihoods, any mixture of these types of combination can be used. Of them all, *sequencing*, has probably been the most widely practised in the past. Whilst aspects of types A, B and C have undoubtedly been used in the field for some time, it is only relatively recently that examples have been documented and disseminated widely (see e.g. PLA Notes 28 and World Bank Technical Paper 366). The latter paper stresses the importance of synthesising of information obtained through combinations of survey techniques.

Box 1: Types of qualitative and quantitative combinations that may be used in sample surveys and experiments

Type A: Swapping tools and attitudes: " Merging"

- Thinking about sampling in designing enquiry based on qualitative methods.
- Coding responses to open-ended questions from qualitative enquiries.
- Using statistical techniques to analyse unbalanced data sets and binary, categorical and ranked data sets, arising from participatory enquiry.
  - creating frequency tables from coded data.
  - modelling binary and categorical data generated from ranking and scoring exercises.
- Using mapping to generate village sampling frames for: questionnaire surveys; type 2 or type 3 on-farm trials.
- Using attitudes from participatory methods, e.g. to reduce the non-sampling error in questionnaire surveys or farmer-researcher misunderstandings in on-farm trials.

Type B: "Sequencing"

- Using participatory techniques in exploratory studies to set up hypotheses, which can then be tested through questionnaire based sample surveys, or via on-farm trials.
- Choosing a random sample and conducting a short questionnaire survey to gain information on key variables which are then investigated in-depth by participatory enquiry.

Type C: Concurrent use of tools and methods from the different traditions: "Mixed Suite"

Concurrent use of:

- Survey of statistically selected sample members, using pre-coded questionnaires to determine target population characteristics of a qualitative (e.g. opinions on a new technology) or quantitative (e.g. crop production) nature.
- Setting up scientific experiments (on-station or type 1 trials) to study the effects of specific interventions in a controlled environment (e.g. on-station or "contract" research).
- Using aerial photographs, GIS.

along with:

- Participatory enquiry for attitudes, beliefs and perceptions of the target population.
- Type 3 trials.

Note:
Type 1 on-farm trials are those designed and managed by researchers. Type 2 trials are designed by researchers but managed by farmers. Type 3 trials are designed and managed by farmers and monitored by researchers. (Coe and Franzel: 1997).

Source: Marsland et al (1998)

Combinations, objectives, trustworthiness and researcher-researched relationship.

Figure1 shows how combinations of survey instruments form part of a continuum in relation to the objectives of a given research project. The different types of combinations need to be seen in relation to the different stages of the research process where they can be applied. Although this paper focuses on survey techniques, it is important not to lose sight of the other stages leading to a research output.

Figure 1: Continuum of Objectives and Combinations of Instruments

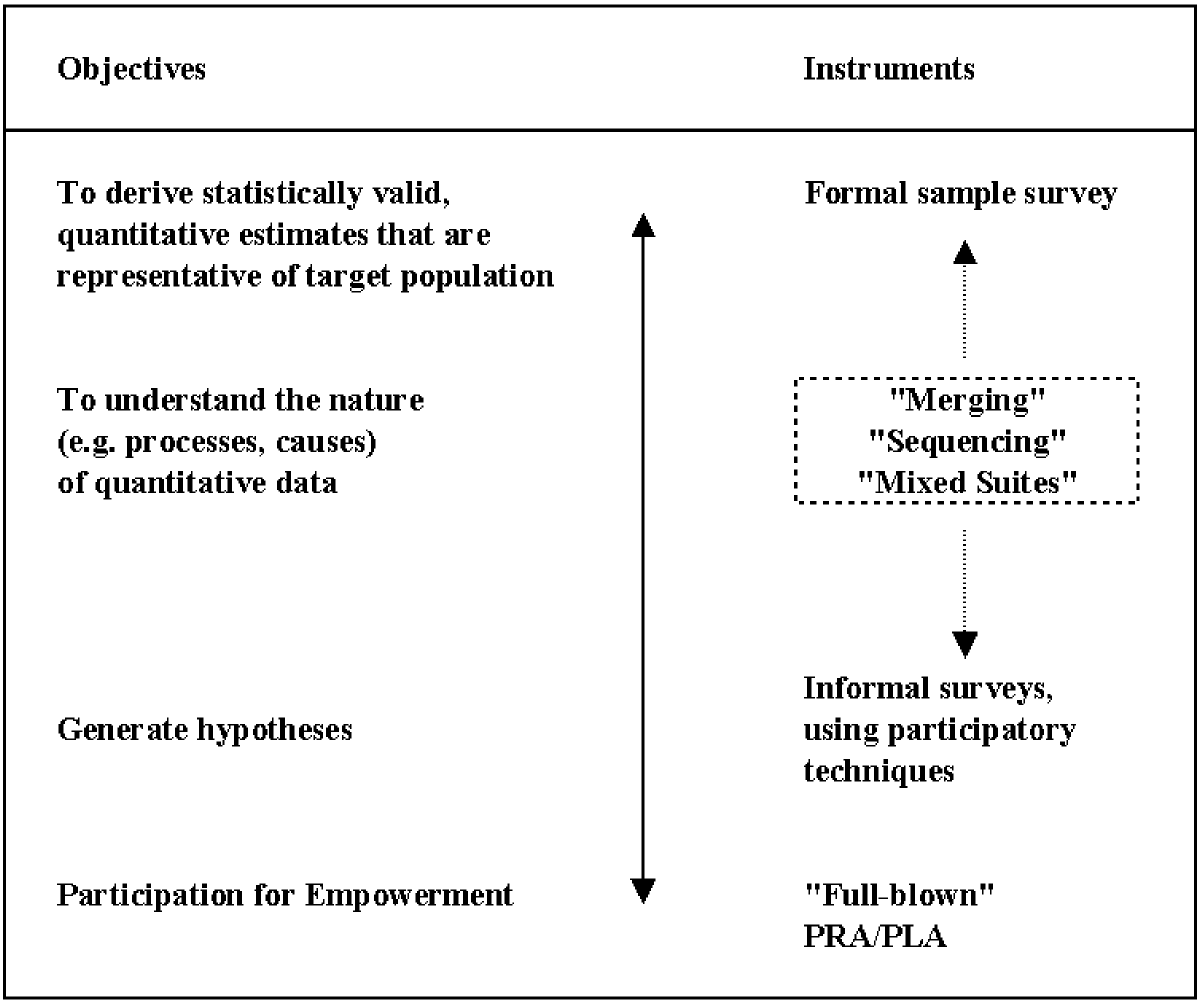


Table 1 presents types of formal and informal combinations at the various stages of the research cycle, and their relationship to aspects of trustworthiness. The latter will be enhanced as a result of "*examining, explaining, confirming, refuting, and / or enriching* information from one approach with that from another" (Carvalho and White, 1997). Table 2 demonstrates the link between research objectives and survey techniques in more detail highlighting at the same time the researcher – researched relationship.

Table 1: Types of informal / formal combinations and their relationship to aspects of trustworthiness

Stage in information cycle	Type of combination	Explanation/Example	Function: Relationship to elements of trustworthiness.
Design	Merging	• Formal sampling procedures for informal work	• Reduced sampling error: better external validity for informal work
		• Informal attitudes for formal work	• Reduced non-sampling error: better internal validity for formal work.
		• Use of social mapping for formal work	• Reduced time and cost for household listing and sampling.
	Concurrent	• Correct use of different instruments for different variables within the same survey/ experiment	• Better internal validity for "qualitative" variables - belief, motivations etc. along-side better external validity for quantit-ative variables - rates, proportions etc. • "Enriching": The outputs of different informal and formal instruments adding value to each other by explaining different aspects of an issue
Data collection	Sequential	• Analysis of informal outputs feeding into the design of formal instruments i.e. using informal studies to "map out" key issues and approaches to be explored further in formal work e.g. using informal work to generate hypotheses to be tested in formal work.	• "Enriching"
Analysis	Sequential	• Analysis of formal outputs with informal approaches. e.g. testing null hypotheses; investigating unexpected outcomes.	• "Refuting": Where one set of methods disproves a hypothesis generated by another set of methods. • "Confirming": Where one set of methods confirms a hypothesis generated by another set of methods • "Explaining": Where one set of methods sheds light on unexpected findings derived from another set of methods.
	Merging	• Applying statistics to categorical and unbalanced data sets.	• Improved credibility of analytical conclusions from informal work.
		• Coding responses from informal work	• Enhances possibilities for aggregation, thus facilitating generalisation. • Enhances possibilities for stratification of sample for subsequent sample survey
Synthesis	Merging	• Blending the analytical outputs from informal and formal work into one set of policy recommendations.	• Higher quality policy recommendations

Table 2: Information Objectives, Approaches to Data Collection and Analysis and Researcher - Researched Relationship.

Information objectives	Type(s) of instrument(s)	Researcher - researched relationship
1. To derive quantitative estimates (number, rate or proportion) of parameters representative of project, regional or national parameters; data to be replicable and verifiable. When quantitative estimates are needed for "credibility".	Formal surveys • Random sampling • Some use of secondary data	Researchers design, execute analyse, present. Researched are passive.
2. To derive quantitative estimates reflecting the area under consideration, willing to accept lower levels of precision because of resource limits; make maximum use of prior knowledge with purposive sampling.	Formal surveys • Purposive sampling • Greater use of secondary data	As above
3. To obtain quantitative data with an understanding of processes causes (diagnosis); data could be used as benchmark data to assess trends, therefore method repeatable with high degree of confidence.	"Merging" or "mixed suite" • Stratification of sample • Use of ranking and scoring and statistics to analyse data • Use of questionnaires • Use of secondary data and grey literature is important	Researchers interact with researched: there is dialogue; semi-structured formats.
4. To understand the nature (causes, trends, add-ons) of quantitative data already available, either national, regional or project formal surveys.	As above	As above
5. When qualitative data (description and analysis of situations, events, people, interactions and observed behaviours) are appropriate to make a decision; when researching characteristics, cultural patterns, motivations and attitudes.	As above - less emphasis necessary on quantification.	As above, but greater use of visualisation techniques; longer time period per data collection event; more open-ended structure.
6. When very little is known about a project area or topic, or wish to move to the next stage of an investment or other action.	As above	As above
7. When the intention is to introduce a project with a high degree of participation and the local people must be involved at the outset and at all subsequent phases. Quantification still possible.	No necessary requirement for sampling; methodology highly location specific and open-ended.	**From:** Researchers working as equal partners with researched; **To:** researchers acting only to facilitate - translating the wishes of the researched.

Derived from Longhurst (1992)

Types of Combinations

Type A: Swapping tools and attitudes: Merging

Informal contributions to formal approaches

(i) Informalising and contextualising interviews in surveys and experiments

Including semi-structured interviewing in a structured questionnaire format can improve the quality of data generated due to increased flexibility and openness, allowing the questionnaire as a whole to adapt better to particular local environments (Ziche (1990) quoted in Mukherjee (1995)). This adaptation ranges from contextualising of questionnaires through use of appropriate locally specific vocabulary, to being better able to deal with certain types of information within a questionnaire format. To some extent qualitative response is routinely incorporated in many questionnaires, with the inclusion of open-ended questions. The addition of a checklist of points or hints for probing on particular issues takes this process one step further and introduces a greater degree of interaction on the part of the interviewee. Summarising any substantial number of such responses requires a careful coding exercise.

(ii) Using maps to create village sampling frames

Once villages in a region are chosen for a study, based on (say) agro-ecological conditions, social mapping can be used to generate a list of households, together with their physical locations within a village. This can then be used as a sampling frame in sample selection. In a 1993 study, India's National Council of Applied Economic Research (NCAER) found that social mapping compared favourably with standard household listings often employed in sample surveys. Box 2 provides an illustration drawn from Marsland et al (1999).

Box 2 : Use of village mapping to generate sample frame

The sample design for project households in a study on co-management of forest products in Malawi was based on a single-stage cluster sample within each of the stratified substrata, with villages as clusters. Project villages were stratified first by association with particular co-management blocks in each reserve and then by proximity to the reserve (i.e. near and far). Because of time and resource constraints, a systematic sampling method was used to select households within the selected villages. The sample frame was generated through a process of village mapping, with villagers marking out the number and location of each dwelling unit in the village, together with the name and sex of the household head. All the names and numbers were recorded by the RRA field teams and a systematic sample was taken. This process was found to be useful for three main reasons. First, it served as an initial ice-breaker, allowing the RRA team to interact with members of the village. Second, and more importantly perhaps, it provided a very rapid and accurate way of generating a comprehensive sampling frame for selected villages. Characteristically, the whole process would take between 1 and 2 hours for Chimaliro Extension Planning Area (EPA) and 1 to 3 hours for Liwonde EPA. The process was slightly longer in Liwonde than in Chimaliro owing to the larger village sizes in Liwonde. Finally, the existence of an accurate village map helped greatly in planning the actual enumeration and dividing tasks between enumerators.

(iii) Using qualitative understanding to inform classification procedures

Cluster analysis is a technique commonly applied to quantitative data by statisticians. Based on a survey, it entails agglomerating the respondents into groups on the basis of "similarity" with respect to responses to some set of survey questions. The starting point is a choice of "cluster seeds" to which others are then joined in the process of cluster formation. If these seed respondents – core members of groups – have been studied intensively and are well understood through qualitative work, clusters formed on the basis of similarity to the seeds will have an understandable character. Ideally, seed respondents are prototypical of what could become effective strata or recommendation domains.

<u>Formal contributions to informal approaches</u>

In some instances, researchers have found it necessary to incorporate more structure into a previously unstructured exercise. For example, one general conclusion of the IIRR/CIP-funded review of Participatory Monitoring and Evaluation (UPWARD, 1997) was that "with the emphasis on participation and learning processes, much of the PM&E experiences started off with using qualitative and semi-structured methodologies. However, there is an emerging recognition of the need to build into current participatory methodologies some of the quantitative tools to provide for better triangulation of information and greater acceptability of the results when endorsed as inputs to policy. This includes paying greater attention to establishing baseline data to more systematically monitor progress and facilitate ante and post evaluation procedures."

(i) Sampling and Stratification

Pretty (1993) argues for the trustworthiness of participatory inquiry, citing the four characteristics of credibility, transferability, dependability and confirmability. It is interesting and important to note, however, that the case for transferability (equivalent to external validity in structured research) appears to be considerably weaker than the one he makes for the other characteristics (Op. Cit., 27-28). It is perhaps in the question of transferability that the most obvious "Achilles heel" of informal research lies, at least insofar as its practitioners try to generalise their findings in much the same way as sample surveys. Effective and statistically based methods of sampling are needed if the domain of validity of research conclusions is to be extended.

Many issues have to be considered in the sample selection process if results are to be generalised to a wider population. Some important issues are (a) a clear identification of the recommendation domain; (b) the use of secondary data and relevant grey literature in assessing the availability of a suitable sampling frame; (c) where a sampling frame is unavailable, evaluating the feasibility of adopting a hierarchical sampling procedure so that sampling frames can be built up for just selected units in the hierarchy; (d) clearly defining the sampling units most appropriate for study objectives; (e) methods to be used in sample selection, in particular, including an element of randomness in the procedure; (f) being open to the possibility of post-stratification at the data analysis stage; (g) sample size considerations. Wilson (2000) gives more detailed consideration to these elements.

(ii) Applying statistical analysis to unbalanced, binary, categorical and ranked data sets

During the 1990s, practitioners of informal surveys and PRA type work in developing countries have started to recognised the potential for applying modern statistical methods to unconventional data sets. Martin and Sherington (1996) and Abeyasekera (2000) amongst others have outlined some of the ways in which statistical techniques can play a useful role for such data.

One starting point is *coding open-ended questions from informal work.* This is common in questionnaire work. What is less common is coding of information collected informally. Certain types of information collected during informal work can be coded readily, and others with rather more careful thought.

Abeyasekera and Lawson-McDowall (2000) describe how qualitative information from farmer activity diaries collected as part of the Farming Systems Integrated Pest Management Project in Malawi (FSIPM) was computerised using the spreadsheet programme Excel and analysed using a statistics package, SPSS. Studies that are relatively large may justify the use of specialist software packages (e.g. NUD-IST) for computerising this type of qualitative data, although these may be time-consuming and difficult to use.

ANOVA: The principal method for the statistical analysis of data from on-farm participatory trials is the analysis of variance (ANOVA). The power of the method lies in its ability to "disentangle", "correct", or in a loose sense, "explain" the effects of one or more factors (e.g. new technologies) on response variables such as results from participatory scoring exercises (Abeyasekera, Op.Cit.). When the data structure is "balanced" (equivalent to equal numbers of observations in cells of 2-way tables concerning factors of interest), the ANOVA is relatively straightforward and is quite well-known. Although "balance" is rare in participatory on-farm trials, the ANOVA technique can allow the simultaneous study of several factors (qualitative, as well as quantitative), and the study of interactions between them. The procedures are easily available in many statistics packages, but their use is generally less well known and they appear not to have been widely applied to on-farm trials. Simple treatment means, which suffice for balanced data, can be misleading in the analysis of unbalanced designs. Martin and Sherington (1996) illustrate this with data from the project "Management of *Imperata cylindrica* in Smallholder Farming Systems". They compare (i) simple means of % *Imperata* cover for different groups, and (ii) adjusted means from an unbalanced ANOVA. The authors were able to separate the effects of the farming system on *Imperata* cover from those of herbicide use, which simple means could not do.

Generalised linear models for binary data: Martin and Sherington (1996) also show how categorising farmers' preference rankings of tree species as "good" or "poor", allows the resulting binary data to be analysed via a generalised linear modelling approach to determine factors which affect their preference. In particular, the dependence of preference ranking on ethnic groups is demonstrated.

Multi-level Models: A recent set of statistical developments extends the idea of general linear models to multi-level models which explicitly acknowledge and model hierarchical information, as found for instance where some data are at community level, some at household and some at individual level. The power of the multi-level modelling method lies in "separating out, "accounting for", or loosely "explaining" the effects of several factors at different hierarchy levels. These up-to-date models do not as yet appear to have been applied to data collected using informal methods in developing countries, but there is clear scope to improve the quality of data analysis by doing so. Pending further development, the above modelling can be quite technical and is likely to require the use of a professional statistician. With time and funds, however, it should be possible to make modelling more user friendly to the NR research practitioner.

Qualitative Residuals: A general idea which runs through regression and ANOVA modelling as well as generalised and multi-level modelling is that of the "residual", the difference between the observed result and that suggested by the model fitted. There is a residual for every observation after a model has been fitted, and the set of residuals corresponds to what is "left over" or "unexplained" after "correcting for" known influencing factors. If a large body of qualitative data is collected, say from a substantial number of separate informants, it is time-consuming and labour-intensive to summarise it. The analogue of quantitative residual analysis is first to account for common features in the qualitative data in a systematic way such as the above, so as then to focus attention specifically on explaining the more individual characteristics.

Ranking and Scoring: Ranking and scoring data arise from activities where precise numerical measurement is inappropriate, including a range of qualitative work, some of it participatory. Ranking entails an ordering e.g. between a set of crop varieties in terms of cooking characteristics. For the same task, scoring would entail assessing each variety separately on a fixed scale, say a four-point scale with values 1, 2, 3, and 4. Simple scoring and ranking data can be analysed very straightforwardly (see Box 3 and Box 4), but where the study has more structure, statistical methods can be used to correct for respondent grouping factors, e.g. respondent's ethnic group and gender. In a substantial number of cases, scoring data can be treated by relatively standard statistical methods, so the results can be modelled and simultaneously corrected for a range of "explanatory factors", even when these occur in an unbalanced fashion (Abeyasekera, Op.Cit.).

Bayesian Statistics: Bayesian statistics is based on the notion of subjective probability or degree of belief. Briefly, the Bayesian paradigm consists of modelling beliefs *before* observing data, by *prior* probabilities, and using Bayes' theorem to combine information from observations with the prior distribution to obtain a *posterior* distribution. Thus, an inference about an unknown is a blend of observed data and subjective degrees of belief. There has been much recent research on the so-called *elicitation* process; this is the process of obtaining the prior probabilities. One area where Bayesian ideas show some promise is in the analysis of causal diagrams (Burn, 2000). These are a popular tool in qualitative enquiries, and recent work by Galpin, Dorward, and Shepherd (2000) has generated "scored" causal diagrams, where participants generate scores for the importance of cause-effect pathways within the diagrams. One set of such data constitutes a descriptive profile of a problem analysis. The question has arisen of combining or comparing several such diagrams, independently elicited. The Bayesian approach to statistical modelling involves a similar type of elicitation, and recent developments in Bayesian networking methods show promise as a toolkit for comparing and combining structured sets of uncertain information. Burn (Op.Cit.) provides more details.

(iii) Procedural aspects of applying statistical analysis to qualitative data sets

A compromise needs to be struck so that informal data can be analysed by using statistical techniques. Some of the flexibility inherent to RRA/PRA exercises needs to be given up in favour of a minimum of rigor, making the data suitable for cross-site analysis. Nevertheless, if well blended into the exercise, this can be done without seriously restricting participation.

The following are a number of aspects to respect during survey design and data collection when considering the application of statistical analysis to qualitative data sets, in particular if the research is to lead to generalisable results:

- The study group needs to be adequately large and representative of the target population
- There has to be an element of randomness in the selection of the study units

- The format of the data collection tool should remain the same throughout the survey (e.g. use of the same format of matrix throughout the exercise; use of a uniform scoring system)
- Well-defined consistent recording of information so that e.g. results from individual PRA practitioners can be coded in a coherent way and put together for analysis
- Clear and complete recording of meta-data, i.e. details of where and how the information was collected, so that information summaries can be based on a clear-cut rationale, and have proper support for any claim to generalisability.

Box 3: Example of a first stage analysis of scored data

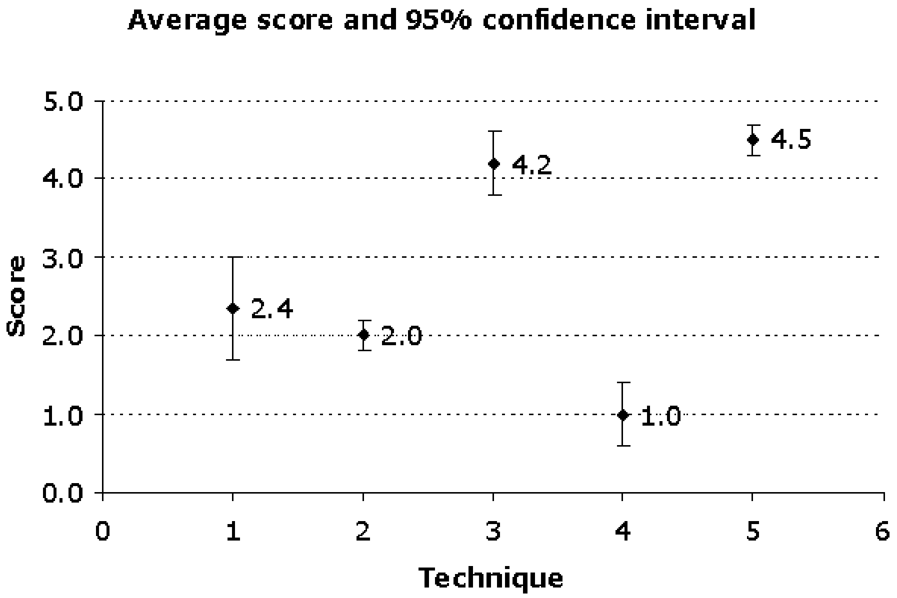
Data: Five techniques were compared by 20 farmer groups as part of a matrix scoring exercise, giving results below.

Group	Tech 1	Tech 2	Tech 3	Tech 4	Tech 5
1	2	1	5	0	4
2	5	2	3	2	5
3	1	3	5	0	5
4	1	2	5	1	5
5	1	2	5	1	5
6	2	2	3	0	5
7	5	2	3	1	5
8	4	3	4	0	5
9	3	2	3	0	4
10	2	1	3	1	4
11	1	2	4	2	4
12	3	2	4	2	4
13	1	2	5	2	5
14	2	2	5	0	5
15	1	2	5	1	5
16	4	2	4	2	4
17	4	2	5	1	4
18	1	2	3	1	4
19	2	2	5	1	4
20	2	2	5	2	4

Statistical analysis of the scores for each technique:

Technique	N	Mean	95% confidence interval for the mean
1	20	2.4	(1.7, 3.0)
2	20	2.0	(1.8, 2.2)
3	20	4.2	(3.8, 4.6)
4	20	1.0	(0.6, 1.4)
5	20	4.5	(4.3, 4.7)

Graphical display of results:



Source: Barahona (2000)

Box 4: Example of analysing ranked data from a study in Tanzania

The Larger Grain Borer (LGB), *Prostephanus truncatus* (Horn), was first reported in Africa in 1981. The beetle, a severe pest of farm-stored maize and dried cassava was initially a major problem to farmers in western Tanzania.

The two principal objectives of the study were:

- To assess the role played by *P. truncatus* in determining changes in production, storage, and marketing of the maize and cassava crop during the period between the time of the establishment of the beetle and today.

- To assess the factors determining the role played by *P. truncatus* in these stages of the maize and cassava commodity system, in particular the impact of the insecticide treatment.

In order to achieve these objectives, a combination of sample survey and rapid rural appraisal (RRA) techniques was required.

In pursuing one component of the above objectives, attempts were made to apply statistics to the ranking data derived from the RRA exercises. Chi square tests and variants thereof were used to test for changes in rankings of the importance of *P. truncatus* when farmers compared the situation at the time of establishment of the pest with the situation at the time of the survey (i.e. 1998). As an example, in one exercise farmer groups were asked to rank the importance of the pest in comparison to all other storage problems (a) at the time of establishment and (b) for the present day. The ranks were then compared and analysed using McNemar's test. The following table illustrates how ranking data for the past and present can be summarised.

		Present	
		Rank = 1	Rank > 1
Past	Rank = 1	24	13
	Rank > 1	2	4

The cells representing no change give no information about how the ranking of LGB has changed over the years. Only the bottom left and top right cells give information about change. McNemar's test (sign test in this case) can be used to test the null hypothesis of no change in attitude. The test gives a p-value of 0.0045, which indicates strong evidence for rejecting the null hypothesis of no change. It is clear from the table that there was a significant increase in the ranking, giving significant evidence for a reduction in the role of LGB as a storage problem.

Source: Marsland, Golob and Abeyasekera (1999)

Types of Combinations

Type B: Sequencing

<u>Informal before Formal in different stages of the research / development process</u>

(i) Formulating and testing hypotheses

Survey work: The use of informal tools before structured questionnaires is an accepted and common practice. The reasons for conducting an open-ended enquiry before a more closed but geographically broader one are well known. Open-ended diagnostic studies help in the process of formulation of hypotheses, which can then be tested rigorously by structured tools such as a questionnaire administered to individuals selected through an unbiased sampling procedure. As noted by McCracken, Pretty and Conway (1987), the primary role of the informal study is to "define and refine hypotheses that are then tested, either formally or informally".

Interestingly, the practice of undertaking informal studies before formal ones has been standard practice in mainstream market research for at least 30 years. The reasons given for this by the Association of British Market Research Companies (ABMRC) are very relevant to renewable natural resources research and development:

"Prior to any large-scale quantitative study particularly in a relatively unknown market, it is strongly recommended that a qualitative phase of research is initially conducted, the main purpose being to understand the vocabulary and language used by customers as well as understanding their motivations and attitudes towards given services, products and usage occasions. The findings of the qualitative research provide invaluable input to the quantitative stage in terms of the line and tone of questioning, and of course the overall structure and content of the quantitative phase" (ABMRC,1989:26).

Experiments: Before formal scientific experiments are designed and implemented, the use of informal studies performs very much the same function in experimental work as it does in survey work. Prior to a programme of on-farm experimentation, it is necessary to get an understanding of local farmers' knowledge, perceptions, beliefs, and practices, and to scope the range of circumstances which may fall in the recommendation domains of conclusions from formal studies. Conroy and Rangnekar (in press) describe the use of participatory techniques (e.g. 'herd history', problem tree analysis), as part of the identification and research issues prior to undertaking on-farm goat feeding trials in Semi-arid India.

(ii) Rejecting null-hypotheses

Casley and Kumar (1987) and Casley and Lury (1982) have commented on the use of informal surveys as diagnostic studies (i.e. to build up hypotheses) and also as case studies to reject null hypotheses in survey work by producing counter-examples. Thus Casley and Kumar note that informal surveys "can be used to disprove a null hypothesis (for example, that a certain constraint does not exist) or to indicate that an assumption of the project plan is not holding true in the cases studied". Casley and Lury point out that "one advantage of the case study method [is that] one may not be able to generalise from it, but one may be able to reject existing generalisations".

(iii) Building up rapport

Formal work, such as on-farm experimentation, requires the development of farmer-researcher understanding and a degree of consensus on the programme of work. This preparatory phase is then likely to provide a pool of potential collaborators who can be "sampled". Participatory activities conducted prior to formal work, can, irrespective of any other benefits, generate rapport and a degree of confidence between farmers and researchers.

It is inevitable that the selection of participants for a long-term activity will involve compromises. For example, the selection of farmer participants in an on-farm study will depend on the willingness and capability of the candidate farmers. A note of caution is needed, because this may affect the "population" to which conclusions can be claimed to generalise; if the non-compliant are likely to be more resistant to adopting new processes, the effects of a research intervention may be over-estimated. It may be valuable to carry forward informal estimates of the participation rate and of the type and importance of differences between those willing and those not willing to be involved.

Formal before Informal in different stages of the research / development process.

Survey work: Whilst the use of informal studies before formal work is the most common form of sequencing, in some cases, researchers and practitioners may conduct a questionnaire survey before a more in-depth informal study. In such cases the questionnaire survey acts as a kind of baseline, the results indicating areas requiring further probing and analysis through informal methods. This type of sequencing will work best in situations where most of the key issues are known or strongly suspected, but further information is needed on causes e.g. in the context of a project or programme that has been going for some time and for which a lot of information has already been collected through an M&E system.

The information from the formal questionnaire both poses the issues which should be addressed in greater depth in follow-up, and provides a basis for selecting individuals whose further participation is solicited. Respondents may be post-stratified or clustered into groups on the basis of information from the questionnaire. This may be deliberately done:

- so that a particular grouping comprises those targeted for follow-up,
- so that the group followed up are broadly representative of all the clusters found in the population, and the follow-up study is made "representative".
- so that differences amongst the clusters can be explored - particularly relevant if the cluster definitions lay the foundations of recommendation domains.

Formal and informal methods used in sequence throughout the research and development project cycle

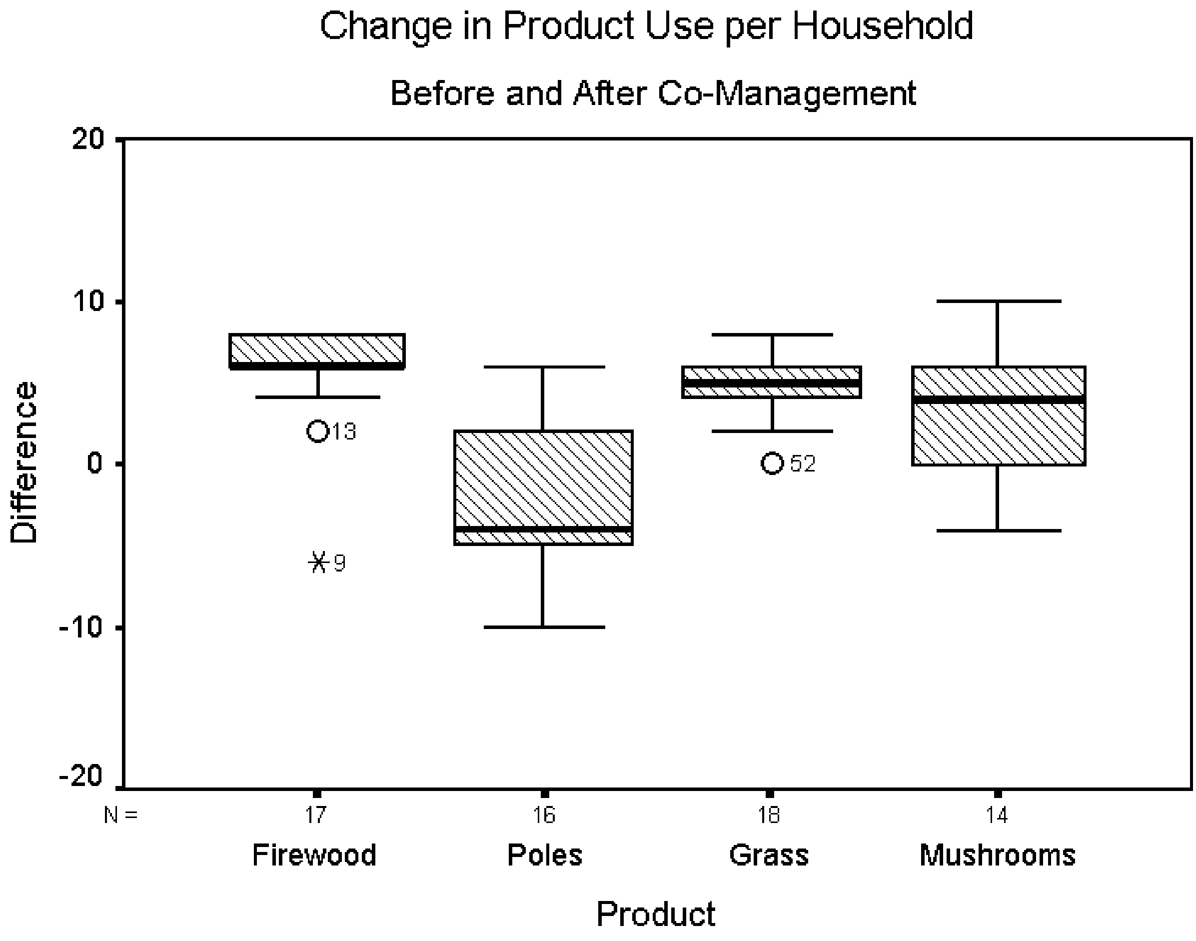
Through defining and refining hypotheses, correcting misapprehensions, providing depth and causal linkages, the informal survey is used in series with formal methods throughout the project cycle from needs assessment to ex-post evaluation. There are several examples of formal and informal methods being used in concert in both research and development contexts.

For example, in relation to research, Hagmann *et al*. (1995) have commented on the benefits of a symbiotic relationship between participatory on farm research (type 2) and formal on-station research in the context of the Conservation Tillage Project in Zimbabwe. In the project, the qualitative results from the on -farm research fed into the on-station work, were quantified, modified and then fed back into the on-farm research and so on. The authors report that the process of integration of formal research into participatory technology development enabled "..both farmers and researchers to develop technologies and had the benefits in terms of data (researchers and policy makers) and a deeper understanding of processes (farmers and researchers)" (Op. Cit., 13).

Commenting mainly in relation to development projects, McCracken et. al. note that "The advent of RRA has .... greatly enriched the availability of methods of analysis for rural development. Techniques can be chosen on the basis of the problem, the local situation and the resources to hand. In particular, different techniques, both formal and informal, can be blended to produce a project cycle..." (Op. Cit., 76).

Box 5: Change in consumption of forest products

As part of the DFID Forestry Research Programme project *"Sustainable Management of Miombo Woodland by Local Communities in Malawi"*, an RRA exercise involved asking farmer groups (on a 1-10 scale) to estimate the magnitude of the change in forest product use before and after co-management. An initial description of the data (see box-plots below) indicated that the majorities of groups felt that access to all products apart from poles had improved under co-management. The box-plots provide a useful summary since (a) the middle line indicates the median; (b) end-points give the 1st and 3rd quartiles; (c) lines on either side of the box extend to maximum and minimum values; and (d) outliers are highlighted. Further analysis via analysis of variance confirmed that the differences were significant and that this was largely due to the mean for poles differing from all the other means.



Source: Marsland, Henderson, and Burn (1999)

Types of Combinations

Type C: Concurrent uses of tools

Survey work: NCAER (1993) found several benefits in using informal and formal techniques together in its evaluation of the "India's National Programme on Improved Chullah". The NCAER experience concerned a geographically broadly spread sample in which a questionnaire was used to collect quantitative or quantifiable information on a limited number of variables. Other mainly qualitative data was collected through RRA / PRA methods from a smaller sample, spread across fewer villages picked from all regions. The questionnaire results provided "representativeness", whilst the RRA / PRA work provided "contextual linkages for explaining behavioural patterns,...[and]....additional in-depth qualitative data which could be helpful during analysis and report writing stages" (NCAER, Op. cit.)
Overall, "The blending of the two approaches can lead to a more reliable data base"; in other words there was a definite "trustworthiness payoff". (See Box 6).

Box 6: Combinations of broad, formal survey and narrow, in-depth study.

It often makes sense to think of a combination of a broad shallow study which provides good "representativeness" and one or more deep narrow studies which provide the depth referred to above. This combination may be thought of as providing a table or platform supporting the research conclusions. When such a combination of studies is planned, it is of course desirable that the sampling structure be planned so that effective merging of conclusions can follow. This implies that the in-depth studies are planned with special attention to how their selection relates to the broad shallow study. For more information on this, refer to Wilson (2000).

As reported by Abbott and Guijt (1997), Schoonmaker-Freudenberger (1996) makes precisely this point, arguing that we should not attempt to extrapolate from PRAs, but instead use the findings to stimulate, "a more accurate debate about a policy issue by identifying the diversity of local conditions. By combining PRA with questionnaires or remote sensing techniques which capture broader *spatial* information, one can derive 'an attractive combination of range and depth of information'". Abbott and Guijt (Op.Cit.). Martin and Quan (2000) demonstrate how Geographical Information Systems (GIS) and PRA can draw from each other.

Table 3 shows the concurrent use of both PRA exercises and formal household questionnaires, while Box 7 shows a similar exercise used for purposes of triangulation.

Experimental work: A further type of concurrent combination is that which involves detailed scientific measurements on the one side and informal investigations of perceptions, beliefs and attitudes on the other. An example of this is the qualitative and quantitative sorghum loss work conducted in India by NRI. This seeks to compare detailed laboratory-based analysis of mycotoxins, pest damage of stored sorghum with farmers' perceptions of the importance of losses (Hodges, NRI , *pers. comm.*).

Table 3: Concurrent use of research tools: LGB study

Thematic area	Research approach
1. Changes in role of crop production in household food security strategies comparing 1985 with 1998.	RRA (Groups of men and women – some single gender groups - ranking strategies for 1985 and 1998)
2. Changes in farmers' perceptions of the importance of maize and cassava, comparing 1985 with 1998.	RRA (Groups of men and women – some single gender groups - ranking both crops against all other crops for 1985 and 1998)
3. Influence of *P.truncatus* on production, storage and marketing outcomes • Production levels • Role of *P.truncatus* in maize and cassava harvests • Role of *P.truncatus* in the choice of maize and cassava varieties • Role of *P.truncatus* in the duration of storage and volume of sales at farm level	Household sample questionnaire
4. Is *P.truncatus* still regarded as a problem? • *P.truncatus* in the context of major agricultural problems • *P.truncatus* in the context of other storage problems	RRA (Groups of men and women – some single gender groups - ranking strategies for 1985 and 1998)
5. Coping strategies for *P.truncatus* • Actellic Super Dust perceptions • Storage operations and structures	Household sample questionnaire

Source: Marsland, Golob, and Abeyasekera (1999).

Box 7: Concurrent use of tools for triangulation

Both formal questionnaire surveys and informal RRA exercises were carried out concurrently in 1998/99 as part of the DFID Forestry Research Programme project "*Sustainable Management of Miombo Woodland by Local Communities in Malawi*". Regarding the importance of the forest products, Table below shows how the results of the RRA confirmed the results of the questionnaire survey.

Comparison of responses from questionnaire survey with RRA exercise: Importance of different forest products

Product	Questionnaire survey %	Questionnaire survey Rank	RRA exercise Rank
Firewood	94	1	1
Grass/thatch	84	2	2
Mushroom	70	3	3
Poles/timber	58	4	4
Rope fibres	28	5	5
Medicine/herbals	24	6	6
Fruits	22	7	7

Source: Marsland, Henderson and Burn (1999)

Conclusions

There are a variety of ways in which qualitative and quantitative methods may be combined to improve the trustworthiness of survey and experiment findings. Several combinations are already known to practitioners in the field, whilst others have not yet found practical expression. It is clear that the choice of particular instruments and combinations will be conditioned not only by the extent to which they improve trustworthiness, but also by time, money, expertise and other factors which can act as constraints to the process of data collection and analysis. Clearly, all information objectives need to be resourced, and, in many cases, the types of instruments used will be as much - or more - a reflection of resource constraints as they are of objectives.

Both, objectives and resource constraints have implications for the selection of survey teams. Aside from the typical multidisciplinary combination of social and natural science inputs, there is a need to consider inputs from statisticians, especially in the more complex cases.

Case study exercises have shown that it is important that survey teams are sufficiently trained and familiar with approaches and have been provided with sufficient resources to achieve their targets. Supervision can be a problem, in particular if exercised over long distances without direct contact. Unforeseen circumstances can push a relatively inexperienced survey team to the limits of its capabilities. If in doubt about the experience of the team and the tasks expected, it may be more appropriate to choose a less demanding survey design.

Well synthesised survey results are required so that decisions can be taken by project leaders or policy decision makers. A unified set of recommendations should reflect a balanced use of tools, which ultimately led to more trustworthy information. Aside from swapping tools for the collection and analysis of data (i.e. *merging* of techniques), findings obtained through the use of one approach can be confirmed, enriched, or refuted by research results obtained from the concurrent or sequenced use of the other approach.

This paper identifies a range of possible combinations of qualitative and quantitative survey techniques, some of which were tested as part of DFID research project R7033. Copies of the various case studies and theme papers written as part of this project can be found at the following website addresses: http://www.reading.ac.uk/ssc/ and http://www.nri.org. The fact that some approaches are relatively untried requires a certain degree of flexibility during design and implementation of research and development projects aiming to improve natural resource use and livelihoods.

References and Suggested Reading

Abbot, J. and Guijt, I. (1997) *Methodological Complementarity: Creativity and Compromise in PLA Notes* 28 February 1997.

Abeyasekera, S. (2000) *Analysis approaches in participatory work involving ranks and scores.*

Abeyasekera, S. and Lawson-McDowall, J. (2000) *Computerising and Analysing Qualitative Information from a Case Study Concerning Activity Diaries.* Case study produced as part of DFID research project R7033.

ABMRC (1989) *Buying Market Research (*Key Note Guides)

Barahona, C. (2000) *Generalising Results from Matrices of Scores.* Case study produced as part of DFID research project R7033.

Burn, R.W. (2000) *Causal diagrams.* Theme paper produced as part of DFID research project R7033.

Carvalho, S. and White, H. (1997) *Combining the Quantitative and Qualitative Approaches to Poverty Measurement and Analysis: The Practice and the Potential.* World Bank Technical Paper No 366.

Casley, D.J. and Kumar, K. (1988) *The Collection, Analysis and Use of Monitoring and Evaluation Data* (Oxford)

Casley, D.J. and Lury, D.A. (1982) *Data Collection in Developing Countries* (Oxford).

Chambers, R (1983) *Rural Development: Putting the Last First.* London: Longman.

Coe, R. and Franzel, S. (1997) *Designing On-farm Experiments: Lecture Notes* (Unpublished). ICRAF, Nairobi.

Davis, R. (1997) *Combining rapid appraisal with quantitative methods: an example from Mauritania.* In PLA Notes 28.

Galpin, M., Dorward, P., and Shepherd, D. (2000) *Participatory Farm Management Methods for Agricultural Research and Extension Needs Assessment*: A Manual. Departments of Agriculture and Agricultural Extension and Rural Development, The University of Reading.

Hagmann et. al. (1995) *Integrating Formal Research Into A Participatory Process in:* ILEA Newsletter Vol. 11 No 2.

Leach, M. and Kamanga, J. (1997) *Shotgun wedding or happy marriage? Integrating PRA And sample surveys in Malawi.* In PLA Notes 28.

Lincoln, Y.S. and Guba, E.G(1985) *Naturalistic Enquiry* (Sage).

Marsland, N. and Golob, P. (1997) *Rapid Rural Appraisal of Post-Maturity Issues in the Central Region of Malawi.* (NRI - Unpublished).

Marsland, N., Wilson, I., Abeyasekera, S., and Kleih,U. (1998) *A Methodological Framework for Combining Quantitative and Qualitative Survey Methods* - Background Paper: Types of Combinations. Report written for DFID Research project R7033.

Marsland, N., Golob, P., and Abeyasekera, S. (1999) *Larger Grain Borer Coping Strategies,* Case study produced as part of DFID research project R7033.

Marsland, N., Henderson, S., and Burn, R.W. (1999) *On-going Evaluation of FRP project: Sustainable Management of Miombo Woodland by Local Communities in Malawi,* Case study produced as part of DFID research project R7033.

Martin, A. and Sherington, J. (1996) *Participatory Research Methods - Implementation, Effectiveness and Institutional Linkages.* Paper prepared for SEM Workshop, ODA, 28-30 April 1996.

McCracken, Pretty J.N. and Conway (1987) *An Introduction to Rapid Rural Appraisal for Agricultural Development.* (IIED).

Mukherjee (1995) *Participatory Rural Appraisal and Questionnaire Survey.* (Concept, New Delhi).

NCAER (1993) *Comparative Study of Sample Survey and Participatory Rural Appraisal Methodologies with Special Reference to Evaluation of National Programme on Improved Chullah.*

Pretty J.N. (1993) *Participatory Enquiry for Sustainable Agriculture.* (IIED - Unpublished).

Pretty, J.N., Guijt, I., Thompson, J., and Scoones, I. (1995) *Participatory Learning and Action: a Trainer's Guide.* London: International Institute for Environment and Development.

Shah, P. (1993) *Questionnaires: Participatory. Reliable and Interesting?* A note prepared for IIED/IDS Workshop on Alternatives to Questionnaire Surveys.

Schoonmaker-Freudenberger (1996) *The use of RRA to inform policy: Observations from Madagascar and Guinea.*

Shanley, P. Galvao, J., and Leda, L. (1997) *Limits and strengths of local participation:* A case study in Eastern Amazonia. In PLA notes 28.

UPWARD (1997) *Participatory Monitoring and Evaluation: The Asian Experience.*

Wilson I. (2000) *Sampling and Qualitative Research*. Theme paper produced as part of DFID research. Project R7033.

Ziche (1990) *Some Critical Aspects in Gathering Socio-Economic Data in Rural Areas of Non-Western Societies, in: Hoeper Qualitative versus Quantitative Approaches in Applied Empirical Research in Rural Development.* (Zed)