DISCUSSION

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Fritz Scheuren's request for approaches to quality in surveys from our two very experienced and knowledgeable speakers reminded me of a biblical story that has some analogy to today's all too brief session. There were two wise prophets of old who were similarly approached to explain the entire meaning of the bible whilst they stood upon one foot. The first prophet refused the request, and in anger expelled the inquirer. The second prophet was more cordial and in his reply are found the seeds of the Golden Rule.

This story leads me to ask "What is the Golden Rule of Quality Improvement?" Widely heard in the world of manufacturing this past decade has been the maxim "DO IT RIGHT THE FIRST TIME". What have our two speakers told us regarding methods for doing just that when designing and implementing surveys? Their presentations are distinct in several ways. Ron has taken a very macro view while Dan's is more narrowly focused.

Ron's Paper

I must wholeheartedly support Ron's opinion that a major impediment to improving quality in service operations is measurement. You will have great difficulty improving what you can not measure because what you can not measure, you can not see. Manufacturers have found the strength of Statistical Process Control (SPC) has been the new vision they have discovered. No longer do people argue in the dark about opinions and gut reactions. Instead, like the surgeon they can now operate more precisely in a well-lit environment. Although the result, the **product**, is easier to measure, it is not the lever that moves the organization to improvement. It is control of the **process** that yields the highest return on investment. In service organizations, we must find ways of measuring the process.

Ron presented us with many stimulating ideas in his overview of methods used to improve quality. I found his unique version of the fish-bone diagram particularly appetizing. His talk whetted our interest in bringing about improved quality, and I believe his highlighting of the role of management to be directly on target. It is management who sets the course for the survey's objectives and for the organization's standards of operation. It is these standards that come to bear when critical decisions are made, decisions about resources and ultimately about quality.

Dan, et al.

The talk by Dan, et al., was a follow-up to a previous paper presented two years ago. The major addition dealt with a composite estimator which can be used to combine the results from the Standard and the current survey. This talk certainly reminded us all that 'new' approaches are not always needed, there are lots of very good 'old' approaches that are not being used. The suggestion of using a composite estimate to combine a more expensive though virtually unbiased estimate with a less expensive though biased procedure has been discussed in many places over the years including in Hansen, Hurvitz and Madow, <u>Sample Survey Methods and Theory</u>, Wiley 1953.

Although the proposed estimator was called a James-Stein estimator, I am more comfortable referring to it as a composite estimate. Dan's discussion was uni-dimensional and involved no concept of prior distributions or a Bayesian approach. It was simply a weighted average of two estimates with weights chosen to minimize the mean square error. A slight modification of this suggestion is the well-known double-sampling method. In this approach, a subsample is drawn and the more expensive method applied to obtain less biased (or hopefully unbiased) results. An estimate from the biased full sample is combined with one based only upon the subsample. Gains in the form of reduced mean square error result, the greater the correlation between the subsample and the full sample, the greater the gains.

Given Ron's title, "Back to the Future", I thought I would do a little crystal ball gazing and try to guess what we can expect from Dan, et al., in the next version of their paper. For one, we might see them remove the assumptions of simple random sampling that underlie their current results. Most surveys in which these methods would be used will not be of the SRS variety. When clustered samples are considered, the computations become more difficult to complete. The proposed composite estimate is likely to be applied when the virtually unbiased estimate comes from a heavily clustered in-person standard sample while the less expensive sample results from lightly clustered telephone or unclustered mail-out contact procedures.

Perhaps, we may see them expand their discussion to take into account the multi-purpose nature of the majority of surveys being conducted. The 'optimum' balance in allocating resources between a 'standard' methodology and the current one is more difficult to strike when there are numerous statistics of interest.

We may also see them use more complex and more realistic cost models. The thought of conducting two surveys in parallel leads me to think that the whole may be greater than the sum of its parts. Two surveys may in fact be more costly to carry out simultaneously than the sum of their costs when carried out separately and independently. Again, the double sampling approach is an alternative for consideration.

Other Comments

I would like to add a few comments of my own regarding approaches to quality in surveys. The environment in which every survey operates contains some aspects which are beyond the control of the survey practitioner. Figure 1 identifies a few of these as 'inputs'. The designer is given a set of requirements with which to work. These requirements include: budget, schedule, precision, variables of interest, etc. These are the given. Although discussions may be held to resolve and clarify, nevertheless, they can be considered fixed and beyond the control of the survey designer. Also shown in Figure 1 are the 'products' of the designer's labor. The output consists of estimates with some degree of error, both sampling and nonsampling. These can be tracked, monitored, analyzed and charted all of which will not lead to assurance that the current survey will meet the customer's specifications. They may lead to mid-course corrections and they may lead to improved design of other surveys. The key to success in planning and carrying out a survey lies in the Processes, the third item appearing in the figure.

The survey processes are those things that are directly under the control of the survey designer. They include the overall methodology of the survey, the instrument and sample design, the recruitment and training programs, the data entry, edit and imputation system, and the estimation procedures. Some of these are shown in Figure 2 as a closed chain of events and not a linear, or sequential process. Certainly the chain of one survey can and should be linked to other surveys. Knowledge gained from one experience should be used to improve subsequent ones. But the closed chain denotes that a weak link in any element degrades the overall result and all the elements are inter-connected.

Survey Design and Sample Selection

The quality of a survey relies upon an overall plan to ensure that the sample design can accomplish the customers goals. The plan must choose among alternative methodologies, generally balancing cost against error in effort to find the right proportions. But it encompasses all aspects of survey activities. Often not included is the relation between the analytic approach to be applied and the survey design. Another frequently ignored aspect is the integration of experiments aimed at finding improved methods for subsequent surveys. Below I mention a number of the more commonly considered details.

The development of a sampling plan usually involves careful definition of a target population and choice of a sufficiently representative sampling frame. Area sampling, or dual frames involving list and area sampling, are often developed to increase the likelihood of the frame adequately covering the desired target population. Dual frame samples involve the use of two or more sampling frames, often overlapping, used to reduce the number of sampling units that have no chance for inclusion in the sampling process. While a dual-frame approach may require greater cost in the sample selection process, through a reduction in the number of units excluded from any chance of selection, they may result in reduced survey biases.

Choices must be made in selecting or constructing a sampling frame that is reasonably current, offers acceptable coverage of the target population, and is free or relatively free from duplication problems. The client's budget and schedule play a role in determining whether an existing, possibly out-of-date or incomplete frame will be used or a new, more up-to-date one constructed. The greater the survey resources and sample size, the greater the relative importance of biases which can be reduced in this way.

The sample plan must include procedures for sample selection that are both operationally feasible and reasonably efficient yet having an acceptable cost. It is surprisingly easy to develop a sampling plan which cannot be implemented accurately or completely because it does not recognize the practical difficulties of field sampling activities. The plan must contain steps for ensuring that sample selection is in accordance with the specifications. Verification procedures may include comparing the sample with known totals, and perhaps poststratification to such totals. When such totals are unavailable, the sample estimates must stand alone. The sampling plan must be designed so as to permit the computation of sampling errors without which statistical inference will be extremely limited.

Instrument Design

Perhaps the single greatest source of nonsampling error stems from the survey instrument. The best approach to minimizing biases introduced by the instrument relies on highly trained, experienced instrument designers and on adequate testing. The instrument is constructed so as to be clear and understandable and to avoid confusion on the part of the interviewer or the respondent. Research into the cognitive process is uncovering better ways to resolve wording and to organize the instrument.

Pretesting and revising an instrument are fundamental to the design process. In this manner, the length of the instrument and its acceptance by respondents can be verified. This pre-testing should not be limited to a handful of survey staff. For large surveys where both the schedule and budget permit, a reasonably sized pre-test involving several hundred respondents selected from the entire sample frame should be conducted. In this manner, instrument wording can be improved and ambiguous questions corrected or deleted.

As with all stages of the survey process, it is preferable to take the time in the design phase to prevent problems rather than to try to correct them after the fact. It is better to design the instrument so as to maximize respondent comprehension and acceptance. This avoids the need to impute for large quantities of missing data records or incomplete items, known in the manufacturing arena as 're-work'.

Recruitment and Training

Ensuring quality in data collection begins with the selection and training of competent staff. Doing so can reduce the 're-work' of retraining and replacing staff not suited to their role. Increasing the interviewers' and supervisors' understanding of the survey objective and procedures will result in higher response rates and reduced respondent error. Accordingly, commit adequate resources when developing training programs for each study.

Well thought-out training programs familiarize the staff with the organization's philosophy as well as all of the steps they will be expected to follow during the data collection period. It provides them with ample opportunity to practice these procedures under the watchful eye of more knowledgeable staff members. It is also used to identify new hires who may not be well suited to the responsibilities.

When bringing staff together for a training session, consider making study material available in advance, such as a home study course where in the staff is paid to complete prior to in-person training. The payoff from having the staff prepare for the in-person training is hard to quantify. It falls into Deming's category of those things that are almost impossible to measure (Deming, 1982). These preparations prevent misunderstandings and help identify problem areas in the training process at the earliest possible stage. Accordingly, this step is judged valuable, especially for larger surveys where biases are more important and the costs of training and preparation represent a relatively small part of the total survey budget. At the completion of any training program, each trainee should be asked to provide feedback on the training program and its instructors.

The training of interviewing staff should be done in person. The program should include a description of the survey objectives and a question-by-question discussion of each item in the survey instrument. Each trainee should receive written materials along with the oral instruction and the training program should involve role-playing in order to provide the trainees exposure to the kinds of experiences they are likely to encounter. Trainees should be presented with typical questions (and answers) that may be raised by respondents.

Quality Assurance in Data Preparation

Broadly, quality assurance activities in data preparation can be divided into prevention measures and detection measures. Prevention consists primarily of more careful design of survey materials and increased effort in the training process. The aim is to eliminate steps likely to lead to errors and to provide quality training and, thereby, ensure a high level of understanding of procedures by the coding/editing staff. Detection consists of inspection steps to uncover errors introduced in the interviewing or in the coding/editing process. It may involve the costly step of either dependent or independent verification.

Each project should incorporate a set of procedures which reflects the needs of the client. Clients expressing greater interest in ensuring accuracy will support more extensive quality assurance activities. Needless to say, these additional steps carry an initial cost in terms of staff time to develop and to implement. Clients should be encouraged to invest in prevention steps believing that these efforts are well worth their initial cost. They result in reduced errors as well as a saving of time spent later to resolve problems such as data retrieval and re-keying that could have been prevented. More importantly, these steps reduce the chances of precipitating problems that may go undetected by the most effective of verification systems.

The Importance of Standardization

A critical concept in the improvement of quality in any operation, service, or production is the need for standardized procedures. Without the development and use of methods clearly understood and universally followed, increased and unnecessary variability will follow. In the preparation of all stages -- recruitment, training, sampling, editing, estimation, etc. -- develop and use agreed-upon procedures.

The importance of standardization remains even in the presence of data collection methodologies that are inherently more variable; for example, where measurements are made through observation or the use of a measuring instrument, as contrasted to interviewing. Emphasize in all surveys the need for training in order to help ensure reasonable uniformity of measurements even those requiring highly skilled operators using sophisticated measurement equipment.

I thank you for the opportunity of discussing some 'new' and some 'not so new' approaches to improving survey quality.

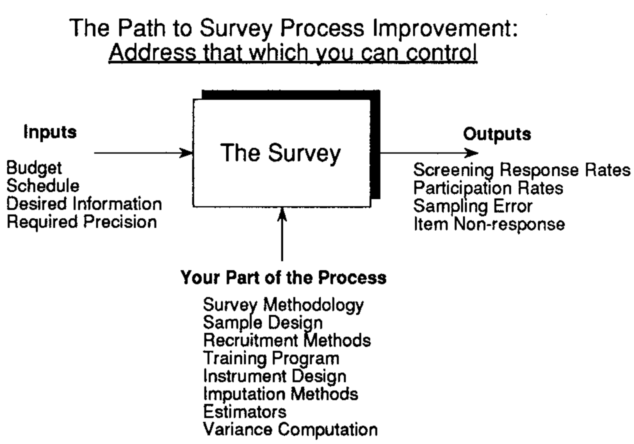

Figure 1.

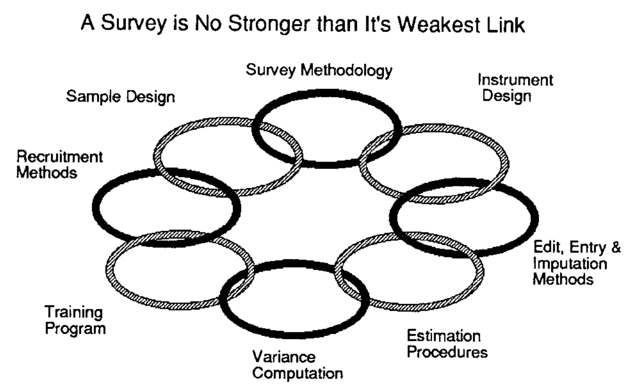

Figure 2.