Component of Statistics Canada
Catalogue no. 12-001-X Business Survey Methods Division

Article

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June 2000

Statistics Canada Statistique Canada

Canada

Survey Methodology, June 2000
Vol. 26, No. 1, pp. 3-10
Statistics Canada, Catalogue No. 12-001

Developments in survey research in the past 25 years

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Abstract

In recognition of *Survey Methodology*'s silver anniversary, this paper reviews the major advances in survey research that have taken place in the past 25 years. It provides a general overview of developments in: the survey research profession; survey methodology – questionnaire design, data collection methods, handling missing data, survey sampling, and total survey error; and survey applications – panel surveys, international surveys, and secondary analysis. It also attempts to forecast some future developments in these areas.

Key Words: Survey research profession; Survey methodology; Survey applications; Questionnaire design; International surveys.

1. Introduction

Survey Methodology is celebrating its silver anniversary this year. In recognition of this milestone, this paper aims to review the major developments in survey research over the past 25 years. I should note, however, that for several reasons I shall be somewhat lax in my dating of events. First, there was, of course, no watershed in survey research in 1975. Rather, many of the major developments over the past quarter century built on the foundations laid by earlier work. Second, it takes time for many advances in methodology to be fully accepted and adopted. Third, I am using as my benchmark a text on survey methodology that Sir Claus Moser and I published in the United Kingdom in 1971 (the second edition of *Survey Methods in Social Investigation*, hereafter referred to as *Survey Methods*), so that my time frame actually extends over 30 years or so.

The paper reviews the developments in survey methodology, including questionnaire design, survey sampling, data collection methods, data processing, and survey analysis. Computers will feature prominently in the discussion since they have had a major impact on many, but not all, methodological developments. The paper also reviews the effects of these methodological developments on the practice of survey research, including the growth in panel surveys, international surveys, and secondary analysis. The main emphasis is on population surveys, but some references are also made to establishment surveys. Also, in reflecting my experience, the paper will no doubt have a slant toward work done in the United States. Before turning to developments in survey methods and practice, I will first describe the great expansion that has taken place in the number of surveys being conducted and the emergence of a clearly identified survey research profession.

2. The survey research profession

Most of the history of survey research is contained in the twentieth century. The field began to take off in the 1930's, grew considerably during the Second World War, and has grown at a substantial rate ever since. By 1975, surveys of both households and establishments were well established as the means to meet the needs for statistical data of policymakers and researchers on a wide range of subjects, such as manufacturing and trade, agriculture, employment and unemployment, family expenditure, nutrition, health, education, travel, aging, and crime. In addition, surveys conducted by academic and other researchers in sociology, economics, political science, psychology, education, social work and public health, public opinion and election polls, and market research have flourished. The field has continued to expand at a rapid rate in the past 25 years, particularly as more policymakers have learned to appreciate the value of survey data and as advances in survey methods have enhanced the ability of survey researchers to respond to the demands for statistical data. The continuing demand of policymakers for more and more sophisticated data has prompted advances in survey methodology and has also led to the solidification of a broadly based survey research profession.

The rapid growth in survey research has come about in part because of an expansion in the range of topics that are considered suitable for study using survey methods. Adventuresome researchers have constantly and successfully challenged the conventional wisdom of their times about the subject matters that surveys could cover. These challenges have continued during the past 25 years so that there are now very few subjects that are ruled out for study in surveys based on valid probability samples. Some of the new subjects of study are sensitive ones, such as sexual behavior and illicit drug use, for which the application of survey methods has required the development of special data collection techniques. Other new subjects have required the incorporation of additional data collection methods, such as medical examinations for sampled individuals, videotaping of teacher-student interactions in classrooms, and placing environmental monitoring equipment in sampled households. Tackling more difficult subject matters has been a constant stimulus to methodological research.

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Prior to 1975 there were no widely distributed specialist journals in survey methodology. Refereed papers on survey methodology were published in a variety of journals. Statistical journals published, and continue to publish, papers mainly on the more statistical aspects of survey research, particularly survey sampling. Journals like *Public Opinion Quarterly* published, and continue to publish, papers on survey methodology. Market research journals publish papers on survey methodology relevant to market research. Journals in various subject-matter disciplines in the social sciences, public health, *etc*., sometimes publish papers on survey methods relevant to their disciplines. This situation was not ideal since there was no natural outlet for some good papers on survey research methods and because the literature was widely scattered. The introduction of *Survey Methodology* in 1975 and the *Journal of Official Statistics* in 1985, both now well-established journals, has remedied this situation.

Another notable development has been the establishment of professional associations for survey methodologists. For example, the International Association of Survey Statisticians (IASS) was founded in 1975 as a section of the International Statistical Institute; the Section on Survey Research Methods of the American Statistical Association was established in 1978, after being a subsection of the Social Statistics Section from 1974 to 1977; and the Social Statistics Section of the Royal Statistical Society was formed in 1976, initially as the Social Statistics and Survey Methodology Study Group.

In recent years, several of these associations, sometimes together with other associations (particularly the American Association for Public Opinion Research), have collaborated to run international conferences on specific topics in survey methodology. A special feature of these conferences is that many of them have been structured to cover their chosen topics in a comprehensive manner so that they could generate well-rounded texts. This feature was introduced to address the shortage of literature on survey methodology that resulted from the fact that survey methodologists are practitioners with little time to publish. The result has been the production of edited volumes on such topics as panel surveys, telephone surveys, business surveys, measurement errors in surveys, survey quality, and computer-assisted survey information collection.

Many other conferences on survey methodology have also been held in recent years. Some have been organized by government agencies, such as Statistics Canada, the U.S. Census Bureau and the U.S. Federal Committee on Statistical Methodology (also founded in 1975). Others have been organized by professional associations, such as the IASS and the Association for Survey Computing. The proceedings from these conferences, and those of the Section on Survey Research Methods of the American Statistical Association, contribute greatly to the growth in the literature on survey methodology.

Two other aspects of the development of the survey profession deserve comment. One is its internationalism. The international conferences described above have led to publications with authors from many different countries. Although there are cultural differences between countries that need to be taken into account in data collection, research on survey methodology shares a good deal in common across countries. In addition, international surveys are becoming more prevalent, with the need to standardize procedures across countries (see the discussion below). In general, international cooperation in survey research is progressing well, but there is one area where much more could be done. Like the developed countries, the developing and transition countries need statistical data from surveys. However, they often lack the necessary expertise. The IASS, international agencies like the U.N. Statistical Office, a number of government statistical agencies, and a number of other bodies make valuable contributions to training survey researchers from developing and transition countries, but the level of support currently available for this training falls far short of what is needed.

Another noteworthy aspect of the development of the survey research profession is its multidisciplinary nature. As survey research has become established as a profession, it has developed a number of subdisciplines. Thirty or so years ago, a survey methodologist might expect to cover all aspects of the subject, but that is no longer possible at the highest technical level. The statistical level of the techniques of survey sampling and survey analysis used by survey statisticians has advanced greatly, survey methodologists are increasingly using theories and techniques from sociology, psychology, and anthropology, and computer specialists now need to use much more sophisticated methods for data capture and processing than in the past. This inevitable segmentation of survey methodology as the field progresses puts at risk a unified professional identification, particularly since the subdisciplines are each also associated with their own different fields. Given the importance of interdisciplinary collaboration in survey research, mechanisms to foster that collaboration may be needed in the future (see also section 5).

As with the developing and transition countries, the developed countries face a shortage of well-trained survey statisticians and methodologists. There is the need both to attract more people into the profession and to provide more training opportunities for them. There are a few graduate programs at universities and some faculty who specialize in the field, but the numbers are inadequate given the needs. The multidisciplinary collaboration involved in constructing and conducting a survey implies that the training should have a multidisciplinary component, so that the various specialists can communicate effectively with one another. Moreover, the instructors should include persons with practical survey experience. These specifications make it even more difficult for a graduate program in survey methodology to be mounted in most universities. An

alternative approach is that adopted by the Joint Program in Survey Methodology (JPSM) at the University of Maryland, a program set up with U.S. government funds to address the shortage of trained survey researchers in the federal government. The JPSM is built on a collaboration of two universities (the University of Maryland and the University of Michigan) and a private survey research organization (Westat), with important contributions from experts in survey methodology in the government, other organizations, and other universities to support its various graduate programs. In a related approach, the Department of Social Statistics at the University of Southampton and the U.K. Office for National Statistics have recently jointly developed a master's degree program in official statistics, with significant teaching contributions in both survey methodology and other aspects of official statistics being made by government statisticians. The Department is also collaborating with an independent survey research organization (the National Centre for Social Research) in the Centre for Applied Social Surveys, one activity of which is to run short courses in survey methodology.

3. Developments in survey methods

The computer revolution that began to have a significant impact on survey analysis in the 1960's has been the dominating force behind the advancement of survey methodology over the past 25 to 30 years. The ability to process and analyze survey data much more readily than in the past has supported the use of more advanced statistical methods. It has also contributed greatly to more sophisticated demands from survey data users, stimulating the development of improved methodology for all aspects of the survey process.

The chapter on processing survey data in *Survey Methods* contains a description of punch cards that were widely used 30 years ago for the analysis of survey data, together with a description of unit record equipment (counter-sorters and tabulators) and computers. At that time computers were well on the way to replacing unit record equipment, but they were not routinely available to survey researchers. The computers of the day were large mainframe machines and punch cards were the usual input medium for survey data. Programs for survey analysis were limited in number and in scope. Today, the situation is, of course, totally different, and the impact of this change on survey research is hard to overstate.

It is against this backdrop of the computing explosion that the advances in other aspects of survey methodology should be assessed. The rest of this section briefly outlines what I view to be the significant advances that have been made in the past quarter century in the areas of questionnaire design, data collection, missing data, survey sampling, and total survey error.

Questionnaire design. The critical role of questionnaire design in achieving high-quality survey data has been well recognized from the early days. While some first-rate research was being conducted on improving questionnaire design in the 1960's and 1970's, the number of researchers involved in tackling this extremely challenging area was very limited. This situation has improved subsequently in large part due to what has become known as the Cognitive Aspects of Survey Methodology (CASM) movement. The CASM movement aims to attract researchers from the cognitive and social sciences to address the difficult problems of formulating survey questions that produce appropriate responses. The attention generated by this movement has created renewed interest in this field.

The CASM movement has not identified ready-made solutions to the problems of response errors in surveys. It would have been unrealistic to expect that all that was needed was the importation of existing theories from cognitive psychology and other disciplines into questionnaire design. What the movement has achieved is greater efforts to tackle the subject from a theoretical perspective. Also, the CASM movement has contributed greatly to more rigorous pretesting of survey questionnaires. Some of the pretesting techniques that have been developed in the past 25 years occurred independently of the CASM movement, but the sustained attention that pretesting now receives owes a great deal to that movement. A direct effect of the CASM movement has been the creation of the so-called "cognitive laboratories" that are now widely used for pretesting questionnaires, using such techniques as "think alouds" and extensive probing. Focus groups – which have a long history in questionnaire design, particularly in market research – are also much more widely used than in the past. In addition, behavior coding is now used widely in pretesting.

An associated development in the past few years has been a more theoretical approach to the design of forms that are to be completed by survey respondents. This research takes account of theories that indicate how individuals approach documents and how they most naturally work their way through them. This important subject received little attention for many years. The current research holds considerable promise for making survey forms much more user friendly, with the hope that this may improve both the quality of the data collected and response rates.

Data collection. *Survey Methods* contains two main chapters on data collection methods, one on mail questionnaires and one on face-to-face interviewing (there is also a chapter on documents and observation). There are only a few minor references to telephone interviewing, in part because of the low level of telephone penetration in the United Kingdom at that time. However, even in the United States where telephone penetration was much higher, back in 1975 many survey researchers had serious doubts about the collection of data for household surveys by telephone, at least for government surveys with major policy implications. That situation has changed considerably. Today, many U.S. government surveys are conducted by telephone.

One concern about telephone surveys is the noncoverage of households without telephones. With telephone coverage in the U.S. currently around 95 percent, the noncoverage of nontelephone households may be considered acceptable for surveys of the general population. However, a sizable number of surveys focus on subpopulations with lower telephone coverage rates, such as the poor; for such surveys telephone noncoverage is a serious concern. Another concern is nonresponse. Nonresponse rates for telephone surveys are appreciably higher than for comparable face-to-face interview surveys, and the gap appears to be widening. In making a choice between telephone and face-to-face modes of data collection, the large cost savings that accrue from the use of telephone interviewing often override the higher response rates achievable with face-to-face interviewing. Nevertheless, the risk of appreciable bias that is associated with high levels of nonresponse in telephone surveys (frequently as high as 40 percent or more, even with determined follow-up efforts) is a serious and often underrated concern. The likelihood of increasing nonresponse rates to telephone surveys raises questions about the role of telephone data collection in the future.

An important advance in data collection methods in recent years has been the introduction of computer-assisted methods, such as computer-assisted personal interviewing (CAPI) and computer-assisted telephone interviewing (CATI). These methods facilitate more complex skip patterns, prevent interviewers from deviating from the specified question sequence, provide for easy insertion of responses from earlier questions (*e.g.*, if a son's name is recorded as "Peter" in answer to one question, "Peter" can be inserted in the wording of a subsequent question), and enable edit checks to be carried out as the interview progresses and corrections made as necessary. By entering the data directly into a computer file, they also permit more timely processing. The development of general purpose programs for CAPI or CATI data collections, including sampling and scheduling, is a complex operation. Several programs are now available for this purpose. Future developments should see more flexible programs and authoring systems that are simpler to apply.

In the past few years, another form of computer-assisted survey information collection has emerged. This is computer-assisted self-interviewing (CASI), of which there are several variants: video-CASI, in which the respondent reads the questions on the computer screen and enters the answers on the keyboard; audio-CASI, in which the respondent listens to questions on headphones connected to a laptop computer and enters the answers on a keyboard; and telephone audio-CASI in which the audio-CASI interview is conducted by telephone, either with the respondent calling into the computer or with the respondent being transferred to the computer interview once the call has been established by a telephone interviewer. All these versions of CASI avoid the respondent-interviewer interactions that apply with other interviewing methods, and may therefore be particularly useful for collecting data on sensitive issues. They can also be developed in different languages if necessary. The audio variants avoid the requirement that the respondent is literate. These methods have appeared only recently and their use may be expected to expand appreciably in the future.

Some business surveys are now conducted using audio-CASI methods. An advantage to respondents is that they can call in to a toll-free number at a time convenient to them. They then listen to voice-digitized survey questions and enter responses on the keypad of a touchtone telephone. A variant of this methodology is for the respondents to answer verbally, with the responses interpreted using voice recognition techniques. The use of this methodology may increase in the future as voice recognition methods improve.

Another recent development has been the collection of survey data over the Internet. This methodology is particularly attractive for some types of establishment surveys and for surveys of populations of individuals who have access to the Internet and experience in using it. One approach is to send the questionnaire by email, which may be suitable for individuals who have known email addresses (*e.g.*, the employees of a firm with its own network). Another approach is to post the questionnaire at a web site, with respondents using a password to gain access to it. At this time, the Internet is not appropriate for use in surveys of the general population because of the high proportion of persons without ready access to it, the lack of a sampling frame, and likely low response rates. The temptation to collect a large sample of Internet responses to a survey questionnaire in an uncontrolled fashion should be avoided. This approach would simply replicate the errors made with the infamous 1936 Literary Digest Poll.

Missing data. Missing data occur in surveys through total nonresponse, item nonresponse, and noncoverage. During the past 25 years and even earlier, there has been increasing concern that total nonresponse rates have been rising. This trend is hard to document and indeed analyses of trend data from different surveys have led to different conclusions about the existence of a trend. Yet there is common agreement among survey practitioners that it has become more difficult over time to obtain cooperation. Various reasons have been suggested, such as less novelty in participating in a survey, more working people with less leisure time, fear of crime in face-to-face surveys, and the negative effects of telemarketing in telephone surveys, but there are no definitive explanations. Whatever the reasons, greater efforts now need to be made to achieve a high response rate than was the case in earlier times. These efforts include increased numbers of calls to contact respondents, greater efforts in refusal conversion, and the greater use of incentives. In the past decade, a sizeable number of experimental studies have been conducted in face-to-face and telephone interview surveys to test the effects on response rates of

various monetary and nonmonetary incentives and the level of monetary incentives, thus replicating in an interview setting the kinds of studies that were conducted with mail questionnaires in earlier decades.

Noncoverage is a recognized concern in telephone surveys, but it has received less attention in face-to-face interview surveys, and certainly less attention than the problem of nonresponse. Yet the level of noncoverage in face-to-face interview surveys among certain segments of the population (*e.g.*, young black males in the United States) can be high. Moreover, little is known about those not covered, except that they can be expected to be different in many ways from those covered. It is a source of survey error that would benefit from greater attention in the future. Noncoverage is often especially severe when a survey of a rare population (*e.g.*, teenagers) is conducted with sample members being identified through a large-scale screening survey. Given the increasing interest in surveying rare populations, this type of noncoverage warrants particular attention.

Twenty-five years ago, item nonresponse was generally handled by simply dropping the cases from the analysis in question, for example computing percentage distributions for the subset of cases with acceptable responses. In essence, the implicit assumption being made was that the item nonresponses were missing completely at random (MCAR). Although that practice is still applied in many surveys, increasingly some form of imputation is being used to assign values for the missing responses in a manner that takes account of responses to other survey questions. This process replaces the often untenable MCAR assumption by a missing at random (MAR) assumption, that is that the item nonresponses are missing at random conditional on the auxiliary variables used in the imputation. Although imputation methods were occasionally used 25 years ago, most of the substantial literature on the subject has appeared since 1975. Current methods rely heavily on the computer power that is now available. Imputation remains an area of active research with two main foci: the development of imputation methods that maintain the covariance structure of the survey data set, taking into account that nearly all of the survey variables may be subject to item nonresponse; and the computation of variance estimates for survey estimates that are based on data some of which are imputed (see the discussion below).

Data editing is closely related to imputation. It has also experienced significant advances in recent years, taking advantage of increased computing power to develop more complex editing procedures than could have been employed in the past. Like imputation, editing is the subject of much current research interest and further developments can be expected.

The growth in computing power is also a major factor in the development and widespread use of weighting adjustments for nonresponse and noncoverage. Weighting class adjustments for nonresponse and noncoverage (poststratification) were applied when unit record equipment was used for survey analysis, but the methods were necessarily relatively simple. Now, more complex weighting class methods and calibration methods incorporating numerous auxiliary variables are widely used, often after exploratory analyses have been conducted to identify appropriate auxiliary variables.

Survey sampling. The main methods of sample design (*e.g.*, stratification, multistage sampling, sampling with unequal probabilities) were developed in the early years and were described in textbooks that appeared in the 1950's. The developments in the past quarter century have been refinements and extensions of these methods, for example to random digit dialing (RDD) sampling for telephone surveys. Here again, the ability of the computer to process large volumes of data in census files and other large sampling frames has enabled survey statisticians to construct more efficient sample designs than in the past.

One area of research in recent years has been on methods for sampling rare populations, either in a special survey or by oversampling in a general survey. This interest is part of the extension of survey demands to provide results for many different domains, including small domains such as racial and ethnic minorities, children in poverty, age/sex groups, and geographical subdivisions (see also the reference to small area estimation below). The aim of the research is to develop efficient sample designs and data collection methods for sampling such domains in situations where special frames for those domains are unavailable. Since the demands for domain results continue to grow, ways to survey rare populations in a cost-effective manner will continue to be sought.

In the 1970's, the design-based mode of inference that is generally adopted with sample surveys was strongly challenged by those who argued that it should be replaced by the model-dependent methods used in the rest of statistics. That debate has waned, and the design-based framework remains in place (see the further discussion below). In this context, the terminology should be clarified: from early on, the design-based mode of inference incorporated the use of models in improving the precision of survey estimates (*e.g.*, regression estimates), but the estimates remained consistent under that mode of inference irrespective of the validity of the model. Thus, the procedures are model-assisted as distinct from model-dependent. The suitability of model-dependent estimates depends on the validity of the model (or the robustness of the estimates to model failure). The computing developments of recent years have facilitated the greater use of models, and of more complex models, within the design-based model-assisted framework of inference.

These remarks should not be interpreted to imply that model-dependent methods have no place in survey research. On the contrary, the methods for handling missing data described above are necessarily model-dependent. Model-dependent methods are also used increasingly in producing estimates for small domains (generally small geographic

areas). Such methods are needed when the sample sizes in the domains are too small (they may often be zero) to produce design-based estimates of adequate precision. In this situation, small area estimates may be produced by borrowing strength from survey data for other areas or time periods through a statistical model that relates the survey data to other, generally administrative, data. The rapid growth in social programs that distribute funds to small geographic entities has led to a substantial demand for up-to-date small area estimates. As a result, small area estimation has become a major area of research activity in recent years, and is likely to remain so in the years to come.

Variance estimation for estimates from complex sample designs has been another major area of development in the past quarter century. Methods based on Taylor's series approximations and replication methods were being used in the 1960's, but they were not routinely applied and were largely confined to research studies. This situation has changed dramatically as a result of the increases in computing power and the development of a number of computer packages for the computation of sampling errors for estimates from complex (typically stratified multistage) sample designs. It is now fairly common practice to compute sampling errors routinely in analyzing survey data.

A notable development in recent years has occurred in the area of the application of analytic models to survey data. This area is one where there remains a debate about the choice between a design-based and model-dependent mode of inference. Within the design-based framework, there have been both theoretical advances in the application of regression models, categorical models, survival models, multilevel models, *etc*., with survey data and in software for computing variances for these models. At present, survey analysts often conduct their exploratory analyses using the greater flexibility of standard statistical packages, and compute the design-based variances using survey sampling variance estimation software only at the final stages of their analyses. In the future, survey sampling variance estimation procedures should become more fully integrated into standard packages.

An area of much current research activity is the computation of variance estimates for survey estimates that are based on responses some of which are imputed. One approach is the application of multiple imputation procedures to complex sample designs, an application that makes strong use of current computing power. Other methods are being developed under the standard design-based mode of inference (necessarily with model assumptions). The future may see the incorporation of these methods into the survey sampling variance estimation programs so that they can be readily applied.

Total survey error. The preceding discussion has treated the various components of the survey process individually. A well-designed survey, however, is the blending together of the components into an effective package taking cost considerations into account. The last 25 years have seen a firmer recognition of the issue, with heightened attention to the concepts of total survey error and total survey design. With constrained resources, a survey design reflects trade-offs between, for example, sample size, the extent of non-response conversion undertaken, questionnaire length, and the quality of data obtained by different modes of data collection. In analyzing survey data, the quality of the estimates should properly be assessed in terms of the total survey error from all sources, not just sampling error. For both design and analysis, detailed information is needed on the various sources of error and their effects on the survey estimates. Moreover, since surveys are multipurpose studies, with many different analytic goals, the information requirements are extensive. The rapidly growing literature on survey errors from different sources is helpful for addressing total survey error and total survey design within cost constraints, but more studies are still needed.

The total survey error and total survey design concepts are most readily applied to repeated surveys. Information on error sources can be accumulated from one round to the next and can then be used to determine priorities for where improvements in the survey methods are most needed. One use of the quality profiles that provide integrated accounts of what is known about the error sources in a survey (see the discussion below) is to guide the choice of priorities for methodological improvements.

4. Other developments

This section reviews a number of areas of survey research in which important developments have occurred in the past 25 years, other than the strictly methodological areas discussed in section 3. The set is not intended to be an exhaustive one. It includes only areas that I consider to have undergone major change.

Panel surveys. The benefits of longitudinal data obtained from panel surveys have long been recognized, and panel surveys were being conducted in the 1940's and 1950's. At that time, however, the complexities of creating longitudinal data sets, combining the data collected in different waves, were severe. Panel surveys were often mostly analyzed only cross-sectionally, and this was a major source of criticism of the method. Today, the advances in computing and also in techniques for longitudinal analysis have changed the situation dramatically. Nevertheless, the complexities of longitudinal data, especially the problem of missing data, remain. Longitudinal methods of analysis are now widely used, although many panel surveys are still analyzed mostly cross-sectionally, with too little attention to the wide range of issues that their longitudinal data could illuminate.

There has been an enormous growth in panel surveys in the past 20 years, covering a wide range of subjects, including education, labor force transitions, health, and voting behavior. Panel surveys of household economics, modeled on the University of Michigan's Panel Study of

Income Dynamics that began in 1968, have become popular and are now being conducted in a sizeable number of countries. There are also panels like Statistics Canada's Survey of Labour and Income Dynamics and the U.S. Census Bureau's Survey of Income and Program Participation that use similar approaches.

It seems likely that the use of panel designs will increase even more in the future. The challenge is to make full use of the longitudinal data produced, since the analytic potential of a panel survey increases exponentially with the number of waves of data it collects. In addition, the significant advances in techniques for longitudinal analysis being made by biostatisticians and others provide the tools for more sophisticated analyses than in the past. Many skilled analysts are needed if the data collected in a panel survey are to be fully analyzed. The growth of secondary analysis (see the discussion below) holds promise for fuller use of panel survey data in the future.

International surveys. The last 25 years have seen the emergence of international surveys of various kinds, ranging from surveys promoted by international agencies to the coordination of independent country surveys to provide cross-national comparisons. A major breakthrough in this area came with the World Fertility Survey (WFS), which conducted surveys in 42 developing countries and 20 developed countries during the period 1974-1982. The WFS not only collected valuable data on fertility, but in many countries it also provided technical assistance in survey research that helped to develop an infrastructure of survey taking. The ongoing Demographic and Health Survey began shortly after the end of the WFS and to date has conducted surveys in more than 50 countries.

Education has been the subject of a number of interna tional surveys including, for example, the Third International Mathematics and Science Study (41 countries in 1995) and its replication (40 countries in 1999); the Programme for International Student Assessment (about 30 countries in 2000); the Second Civics in Education Study (about 20 countries in 1999); the IEA Reading Literacy Study (about 30 countries in 1991). The ongoing International Adult Reading Literacy Survey is collecting comparable information about literacy levels of adults in a number of countries around the world. Two examples of other internationally organized survey designs are the Multiple Indicator Cluster Survey from UNICEF and the Social Dimensions of Adjustment Integrated Survey from the World Bank. A related activity is the coordination of surveys in the European Union by Eurostat. An example of cross-national collaboration on surveys is provided by the International Social Survey Programme, a continuing annual survey program on social science topics that now has 33 member countries.

The development of international survey programs has occurred for two separate reasons. One is the growing interest in the comparison of survey results across countries. The other is to assist countries, particularly developing and transition countries with limited survey experience, in the conduct of surveys that will provide important data for planning purposes. Considerable expansion in international survey activity can be expected in the future for both of these reasons.

Linkages to administrative data. The increases in computing power and the resultant ability to conduct more sophisticated analyses have led to a demand for more data on the sampled units. Analysts want to answer more complex questions than was the case in the past and some of the data they need may not be readily collectable in a survey, at least with the required level of quality. Even if the data were collectable, the collection could create excessive respondent burden. This situation has led to the search for alternative sources for the data, with data taken from those sources then being linked to the survey responses. Thus, for example, tax records might provide valuable earnings histories for sampled individuals over a timespan for which the respondents could not provide the data, or medical records might provide the amounts of medical expenses paid directly by insurers that are unknown to the respondents. These kinds of linkages have been made much more feasible by the significant expansion in the number of administrative record systems now available in electronic form.

There has been considerable interest in linking administrative record data to social survey data in recent years and a number of surveys have made such linkages. However, there are generally significant problems to overcome in gaining access to administrative data and serious concerns about protecting the survey respondents' privacy. These issues have severely limited the use of administrative record linkages in household surveys to date. Despite the substantial potential benefits of such linkages, it is not clear to what extent these barriers can be overcome.

In contrast, administrative data have become a key element in the conduct of economic surveys and censuses and, in a number of cases, they have replaced the data that used to be collected from respondents. The result has been a substantial decrease in respondent burden, improved data quality, more timely reporting, and reduced costs.

Secondary analysis. The increases in computing power, the increasing numbers of surveys being conducted, and the increased sophistication of the data collected in surveys have all stimulated a major growth in the secondary analysis of survey data. Public-use files are now more routinely made available, sometimes through survey data archives, to enable secondary analysts to conduct their own analyses, thus permitting survey data to be more thoroughly analyzed. Associated with this activity, increased attention has been needed to protect the survey respondents' confidentiality and to ensure that data files released to secondary analysts are not used to breach confidentiality. With secondary analysis undoubtedly continuing to expand in the future,

continued attention will need to be given to ways to release survey data in a manner that protects respondents but does not seriously curtail the range of analyses that can be conducted.

Survey quality. Increasing attention is being given to different aspects of survey quality. In the past few years, a number of survey organizations have become interested in survey process quality, applying the ideas of total quality management to survey processes. Greater attention than in the past is being given to quality taken in the broad sense to include the accuracy of the estimates produced, relevance, timeliness, accessibility and cost-efficiency and in the narrower sense of accuracy alone. Users of survey estimates and secondary analysts of survey data need to be informed about the overall quality of the survey data, including sampling errors, nonresponse and noncoverage, response errors and processing errors. While this need has long been recognized, current practice in reporting survey quality is often seriously deficient. There are signs that more attention is now being given to this area. The introduction of quality profiles that provide full and integrated reports on the quality of the data in ongoing surveys is an important contribution.

5. Concluding remarks

This section attempts to predict some major considerations for survey research in the next 10 to 20 years. The computer revolution that has transformed the nature of survey research over the past 25 years is still in progress, and further developments can be expected in many aspects of collecting, processing, and analyzing survey data. The telecommunications industry is also in a state of rapid innovation, and the changes are likely to affect the ways that survey data are collected. It seems likely that greater use will be made in the future of mixed-mode designs, taking advantage of new modes for respondents with access to them (*e.g.*, the Internet) and using conventional modes for other respondents. Thus the effect of mode on survey responses will continue to be an important concern.

In general, it seems probable that the demand for survey data will continue to grow rapidly as more policy analysts learn to take advantage of survey data. Increasingly, survey estimates will be needed for small domains, especially small geographic domains, as policymakers target their programs to special population subgroups. Currently, most of the demand for survey data comes from central governments; in the future the demand from provincial and local governments may expand. The difficulty here is that surveys cost almost as much for small populations as for large ones. Local governments may therefore often be unable to afford the cost of a survey unless inexpensive methods can be found.

The major concern for the future of survey research is that respondents' willingness to participate in surveys may continue to decline, and that increased efforts in data collection will not fully counteract this effect. Thus, response rates will fall. This comment is of particular salience for telephone surveys, where nonresponse rates are already high. A significant increase in telephone nonresponse rates could even lead to the demise of telephone data collection for household surveys.

Finally, the next decade or so may well see the emergence of a new and different professional society for survey researchers that more broadly represents the interests of all members of the profession. Since survey sampling was at the forefront of the developments of survey research in the early years, survey research has strong ties with statistical societies. However, those ties tend to concentrate on survey statistics. There are also ties with societies for public opinion research, market research, and various subject matter disciplines, such as sociology and psychology, primarily for survey researchers who deal with the nonsampling aspects of survey research. Similarly, there are ties with computing societies for those working on survey computing. As yet, however, there is no society that aims to bring survey researchers of all disciplines together. The years to come may see the creation of such a society to promote exchanges across the different disciplines and thereby help to advance the field. Were such a society to be formed, it would not affect the need for the current ties that survey researchers have with statistical and other societies. Survey researchers need to keep in touch both with the developments taking place in survey research broadly and also with the developments in their own disciplines.

Acknowledgements

I am grateful to Joe Waksberg and Dan Levine for helpful suggestions in the preparation of this paper.