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Suggestions for the Application of Advanced Technology in Canadian Collection Operations

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Abstract: Census taking in the 1990s will have to meet the challenges posed by a number of different and sometimes conflicting goals. Those who sponsor censuses are interested in reducing costs via a reduction in labour intensive procedures and activities. Other kinds of pressures come from the respondents themselves who demand that their needs and concerns be accomodated to. Technological advances will facilitate our data collection, personnel training, field monitoring, and processing activities and, we hope, will foster good relations with respondents.

When considering implementing a given technology, one must consider its impact on costs and data quality, and the time needed for development and extensive testing. This paper reviews a number of options and points out areas of interest for future censuses.

Key words: Technological advances; data collection; hand-held computers; enumerator training; training effectiveness; respondent relations.

1. Introduction

This paper discusses a number of technical advances that aid collection activities. Although we most often associate advanced technologies with improvements, these technologies will also further complicate the difficult environment we work in. Invasion and protection of privacy will become even more prominent issues as information processing technologies become more sophisticated. The increased use of technology will help reduce the cost of census taking, but it will also bring with it new problems and debates.

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2. Data Collection

The most labour-intensive activities in a census are collection operations and manual coding /processing operations. In the 1986 Canadian Census these two activities will employ a short-term staff of 45 000.

Employing technology in data collection has many potential benefits. We are rapidly approaching the era of data collection by hand-held computer (HHC). HHCs range in size from 10 cm x 20 cm x 4 cm and 0.5 kg in weight (pocket calculator size) to 30 cm x 20 cm x 7 cm and 3 kg in weight (also described as lap top size). The various models offer displays from 20 characters to an eighty column by forty row screen.

The use of HHCs in census collection might not necessarily reduce actual collection costs,

but may yield financial savings in other phases of the operation. HHCs would eliminate key entry and all the preparation accompanying key entry, like separate manual coding. For the 1986 Census of Canada key entry and its related activities represent approximately 15 million Canadian dollars or ten percent of the total census costs.

HHCs also provide tighter control over the interview process itself by prompting the interviewer to ask only necessary questions as determined by the questionnaire's design and prior responses. Programmed edits would notify the interviewer of inconsistencies and allow for correction within the initial interview. This reduces the need for follow-up interviews and improves data quality.

There are, however, problems that must be solved before HHCs can be put into large scale use. As Bemelmans-Spork and Sikkell (1985) have pointed out, HHCs at a reasonable price with the technical sophistication needed to conduct a complex survey are not yet available. On the other hand this does not mean that the technical knowledge to develop the ideal HHC for data collection is not currently available. It may be that the market for this type of equipment is not apparent. Regardless whether one acquires the HHC "off-the-shelf" or has it custom developed for survey data collection, one must weigh the total acquisition and systems development costs against the savings gained from the elimination of labour intensive operations.

HHCs could be introduced in conjunction with other systems and procedural changes. For example, consider the possibilities presented by Optical Character Recognition (OCR). OCR equipment is an input device that can scan and recognize handwritten characters on a document. This evolving technology could conceivably provide primary edit, coding and capture simultaneously, thus eliminating enumerator edits, manual processing and coding, and key entry as well as the controlling and logging in of returned documents.

There would still, however, be a need for follow-up on those documents that fail to pass edit checks for inconsistencies or item non-response. This could be done in either a centralized or decentralized computing environment. In a decentralized environment, the relevant questions for item nonresponse households and the appropriate questionnaire for nonresponse households could be electronically transferred from the OCR system to the appropriate storage medium for a HHC. The primary edit designed for the OCR application could be transferred as well, thus ensuring that the field work, when returned, is consistent and "clean." In a centralized environment, a Computer Assisted Telephone Interviewing (CATI) application for item nonresponse and household nonresponse would best be utilized in urban centres. HHCs could then be employed to complete follow-up on households that, for various reasons (unlisted number, no phone, phone answering device), could not be reached through the CATI application.

HHCs could be employed on a less ambitious scale in traditionally difficult to enumerate areas such as densely populated urban areas or remote aboriginal settlements. This approach would improve quality by reducing the number of errors and the number of follow-up visits required to complete an interview. In addition, this approach gives greater control over both the cost and the quality of the data collected by including quality control checks in the system itself.

The use of this type of technology in a census could also present some new concerns. The census, by its very nature, is not the proper vehicle for research and development. A census must employ proven technology. The implementation of any new technology must be thoroughly tested and studied for its effect on data quality. Given these prerequisites, actual implementation of these procedures may be restricted by costs.

Additionally, there is the question of the respondent's reaction to such a system. While

Bemelmans-Spork and Sikkell (1985) concluded that respondents are willing to answer questions when HHCs are used in a sample survey, there is a substantial difference between sample surveys and the typical census. A sample survey typically has a low profile, without the public being very much aware of the data collection. A census, on the other hand, is conducted in a completely different climate. A census is high profile, with widespread public awareness and considerable media attention. This climate may breed a different respondent reaction.

3. Training

Utilization of sophisticated technologies also offers benefits for enumerator training. For the 1986 Census of Canada there will be 32 956 enumerators. Each enumerator will receive 8 hours of self-instruction blended with 6.5 hours of classroom instruction. The cost of this instruction will be 2.47 million Canadian dollars. Travel to training classes will bring the total cost to 3.1 million Canadian dollars. Expressed in other terms, each minute of the planned 1986 enumerator training program will cost $2 800.

Currently the training of collection staff is almost exclusively a "paper" exercise. There are several areas where the use of relatively simple equipment could be used to reduce costs. During the 1980 U.S. Census, a series of audio cassettes was used to introduce new regional office staff to the census programme. A similar programme could well be used to orient field supervisors and introduce preliminary activities. Given the widely dispersed supervisory staff, any reduction in regional office training will yield substantial travel savings. At the present, audio cassettes are used extensively in training for on-going programmes at the junior levels (e.g., Labour Force Survey, National Farm Survey), but have not been utilized in a substantial manner for census training.

They could facilitate census training in several ways, for instance, to emphasize key points or as a "refresher" course for enumerators. The refresher courses could be connected to a telephone answering machine. A "help" line could be established and if the field supervisor is not available to receive calls, the refresher course could be played.

Another area worth exploring is the use of Video Cassette Recorders (VCR) in training. VCRs were used on an ad hoc basis in the 1981 Census of Canada to train senior field supervisors on hiring and public relations. While generally effective, several constraints with VCRs were evident. First, limited availability has precluded more widespread use. Additionally, produced and documented video tapes require a great deal of time to prepare. Video tape is also an inflexible medium. Thus, minor procedural change could undo a lot of work. Nevertheless, with the more widespread availability of VCRs in Canada and with the current evolutionary state of this medium, some aspects of the census training program could be put on video tape. VCRs could be used to train staff to handle refusals or difficult respondents, to delineate responsibilities, and to explain other procedures that are less effectively covered through "paper" exercises. A potential problem given the high percentage of students who will be hired in the 1986 Canadian Census is a higher than normal turnover rate of enumerators. To avoid burdening important staff members with a never-ending stream of training classes (especially during critical operational periods) it would be advantageous to have the follow-up training on video cassettes. The video could interact with a self-administered study guide to train the new enumerator.

With the cooperation of community cable TV channels or educational stations, video cassettes could be used on a larger scale. Ninety-eight percent of Canadian homes have at least one black and white television (Statistics Canada (1984)). The current self-study

programme could be supplemented with pre-recorded illustrations of key points, broadcast on community or educational channels at off-peak times.

Other areas to explore are the use of microcomputers and/or HHCs to assist in the training of support staff. There is currently available a relatively inexpensive ($250) HHC designed to interact with a self-administered study guide. The trainees follow the study guide which is divided into chapters by topic. The guide indicates the relevant sections of the related manual that should be reviewed. At the conclusion of the topic, trainees then complete a review exercise, recording the answers on the HHC. The memory modules of the HHC interface with a microcomputer to produce data on the effectiveness of various aspects of the training package as well as information on the performance of the trainees. It would be worthwhile to use this application to test the effectiveness of enumerator and/or field supervisor training. Misunderstandings would be highlighted, and improvements could be implemented in a future census.

4. The Control and Monitoring of Field Activities

Technological advances will greatly assist the control and monitoring of field activities. Maintaining lines of communication with a widely dispersed large staff is a difficult, yet essential task. A single procedural change after training, a request for additional information beyond the scope of an enumerator, or requests for cost and progress reports require thousands of phone calls to implement. (In the case of the Canadian Census, over 41 000 phone calls are required to communicate a change.) During the early phase of field operations, field supervisors travel constantly to recruite staff and perform field checks. Travel itineraries are frequently adjusted to accommodate enumerator candidates or to adjust to a changing situation. This makes communications with a supervisor difficult. This problem is best remedied by a centralized "mailbox" type message system. Such systems are currently becoming available. In Canada, the most popular system at present is known as "Hello Central." It works very much like the Envoy 100 or other similar electronic mail systems. Audio messages are left in a mailbox that is accessed through a touch-tone phone. It can also be accessed from a rotary phone using a tone simulator.

The new generation of facsimile machines will expedite the processing of enumerator cost and progress reports as well as reducing costs. Transmission times for some of the newer machines are as low as 30 seconds compared to four or six minutes for the older machines. On days when seven or eight reports are due from field supervisors, line charges will be greatly reduced and receipt and compilation of the cost and progress reports should be much shorter. More importantly, there will be more time for analysis and reaction from the field supervisors and regional offices.

The cost and progress reporting system itself is a prime candidate for further automation. Microcomputers will be used in the regional offices in the 1986 Census of Canada for the first time. In the future, microcomputers could be used at the field supervisor level to further expedite the flow of cost and progress data. This use of microcomputers would also help to eliminate errors and inconsistencies in the reporting of cost and progress data. In addition, microcomputers would assist the field supervisor in monitoring a variety of activities like: enumerator hiring and training, the flow of pay claims, and the processing of other financial records.

5. Respondent Relations

New telephone technology will help to make more effective use of the Telephone Assistance Service (TAS) staff. TAS is designed to

aid respondents in completing their questionnaire and to respond to general questions on census procedures. The phone numbers for TAS are published on the Census questionnaire and in promotional material. With some minor regional differences, TAS specifications for the 1986 Census of Canada call for a series of single line sets linked on a "ring-down" or call forward system. With this system a primary phone number is established and published on the census questionnaire. Additional lines are linked to the primary number so that a call placed while the primary number is engaged will be routed to the first phone in the series that is not engaged. The system is designed to route a call to the first free line in the series. One of the problems that arises is that those lines closest in sequence to the primary number and the primary number itself tend to be very busy. At the same time, those lines furthest removed in sequence from the primary number tend to be under-utilized. The end result is that operators at the beginning of the series receive another call as soon as they put the receiver down; while operators at the end of the series receive calls infrequently.

The solution to this problem is to route incoming calls through the entire series before routing a second call to the primary number. This is known as call distribution and is not possible without adding expensive equipment. Because of the short duration of TAS, approximately ten days, it has not been practical to acquire this additional equipment. Call distribution is a feature available on new telephone switches which will be installed in most urban centers in the next few years. Call distribution will ensure maximum use of TAS staff. On-line monitoring systems will be in place to provide more detailed information than currently available so that refinements in the scheduling of staff can be improved.

Another possible area to study is the feasibility of establishing a call-in system of reporting census data. Public utilities such as the phone company and the hydro-electric company use this system to record billing information when the meter reader fails to find someone at home. Clearly there are a number of problems with this idea, but some form of call-in service, to at least record appointments or suggested hours to call, could produce savings in follow-up interviews.

6. Summary

Increased pressure to reduce costs and address the concerns of respondents will force national statistical agencies to examine technological alternatives to labour intensive, activities. When applied to collection activities, technology may reduce costs and improve timeliness. Training programmes can be made more effective through the use of technology. These advances will also improve the coordination and supervision of a large field staff.

On the other hand, concerns over privacy and privacy protection will remain, possibly even increase, as more sophisticated equipment is employed. New technology must have proved itself before it can be used in a census. The testing of new technology is impeded in a census since the "one-time" nature of a census does not allow for the research and development of untried systems. Also there is considerable preparation required to acquire and develop new hardware and systems that does not really fit with census operational requirements.

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