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THE CANADIAN INNOVATION AND TECHNOLOGY SURVEY: SURVEY DESIGN AND DATA COLLECTION

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SUMMARY

The Canadian Innovation and Technology Survey completed data collection at the end of March 1993 and achieved a response rate of 89% from firms and plants in manufacturing. The survey was complex and the high response rate was due to an innovative system which managed the data collection, and also to the use of experienced telephone interviewers. Results of the survey will be released during the rest of 1993 in publications of Statistics Canada.

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1. INTRODUCTION

This paper describes events leading to the development of the Canadian Innovation and Technology Survey and to the data collection in the first quarter of 1993.

Globalization and technological change have been issues on the public policy agenda for many years and were central to the Technology and Economy Programme (TEP) of the OECD. The TEP ended with the recognition that there were gaps in the understanding of systems of innovation, how they differed from country to country, and how they were influenced by global technological change. Technological innovation was recognized as a key to competitiveness, but the information was not there to support the development of public policies to facilitate innovation or to contribute to it. This was the context in which the Canadian innovation and technology survey developed.

The innovation survey was modelled on earlier work of the Economic Council of Canada, taking into account the OECD OSLO Manual, and discussions with experts from Europe and the U.S. The technology part of the survey was based on American, Australian and Canadian work on technology use and planned use and on a recent survey of problems in the adoption of technology conducted by the U.S. Bureau of the Census. Following the Oslo Manual, the technology section had questions on sources of ideas and technologies and on barriers to adoption. A section on intellectual property was based on a survey of the Canadian Department of Consumer and Corporate Affairs and on draft questions for an internationally comparable survey of appropriability proposed by Richard Nelson and Sylvia Ostry.

In April 1992, the survey, as part of the Technology and Adaptation Project, moved to Statistics Canada from the Economic Council of Canada. As a result of the move, the project objectives were broadened to accommodate the information needs of the clients of the Agency and to fit in with the on-going programme of measurement in science and technology.

The survey was supported by two Canadian federal government departments, Industry, Science and Technology, and Consumer and Corporate Affairs, two provinces, Ontario and Quebec, and by funds transferred from the Economic Council of Canada. It was conducted by Statistics Canada.

2. THE QUESTIONS

The survey covered 8 topics and a total of 75 possible questions, which are given in their entirety in a separate document [1]. The topics were: general questions about the firm (11); research and development (5); innovation (4); characteristics of

innovation (27); intellectual property (4); advanced technology use (2); acquisition of advanced technology (15); and, impediments to the acquisition of advanced technology (7).

The objective of the survey was to improve the understanding of innovation and technology use in the firm and its plant(s), in relation to its research and development activity and its use of intellectual property mechanisms. To achieve the objective, the 75 questions were drawn from a variety of sources.

The questions on innovation were influenced by early work in Canada of DeMelto [2] on innovation, the American and European surveys of innovation, the Oslo Manual [3] and the expert meetings to agree on a common innovation questionnaire for the European Community and the OECD. The OECD TEP exercise [4] had demonstrated a public policy requirement for information on innovation and the transfer of the project to a statistical agency imposed the requirement that the results be reproducible over time at a reasonable cost.

At the same time, there was a move to develop internationally comparable surveys on the appropriability of intellectual property, based on the earlier work of Levin et al. [5]. This was promoted by Richard Nelson of Yale and Sylvia Ostry of the University of Toronto and the subject was reviewed at an international seminar organized by the Institut National de la Statistique et des Etudes Economique in Paris in 1992 [6]. In Canada, there was the influence of a survey conducted by the Department of Consumer and Corporate Affairs [7].

The acquisition and use of technology [8] was related to work of Robert Tinari at the U.S. Bureau of the Census and Australian and Canadian work [9] on technology use. The questions on technology acquisition used in the survey were very close to the U.S. survey recently conducted by the U.S. Bureau of the Census, and will provide a basis for comparing the Canadian and U.S. data when both are available.

3. SAMPLE SELECTION

3.1 The Register

The Statistics Canada Business Register is based on administrative records for businesses with employees, augmented by nature of business reports. The basic unit on which information is stored is the firm. However information collected through surveys on production units within the firms is also held and updated after each survey cycle. The Register is divided into large firms and small firms with more information maintained for large firms.

The principal advantage of using the Business Register is the ease of linkage to other survey and administrative information, held at Statistics Canada, for each of the survey units. This reduces burden on respondents and maximizes information for analytical purposes.

3.2 The Universe

The universe for the Innovation and Technology Survey was all manufacturing plants in Canada for which there was information on the Register.

3.3 The Sample

The sample was drawn from all manufacturing plants on the register, subject to certain conditions. The final sample was required to have about equal numbers of plants from large and small firms and to support analysis both at regional level and at the level of two digit aggregation of the 1980 Canadian Standard Industrial Classification (SIC). The final sample of 4951 plants included an enhancement of about 500 plants each for the two sponsoring provinces.

As some analysis was to be done for firms, as well as for plants, selection probabilities had to be calculated and retained for both. These were identical for single plant firms, and for multi-plant firms, the probability of the firm's selection was one minus the probability that none of the plants were selected. These probabilities were retained for estimation of characteristic means or ratios of the population of manufacturing firms or plants. Of course, the industrial classification of firms could differ from that of the plants in the case of multi-plant operations, and this was also noted.

4. TESTING

Before the survey was conducted, there were tests of the questions and of the survey system and as a result, modifications were made to both. During the tests, the information drawn from the Business Register on the structure of multi-plant firms was also assessed. These tests were essential to the success of the survey.

In the last quarter of 1992, a content test was conducted by the Toronto Regional Office of Statistics Canada. The approach was to contact firms and seek agreement for an on-site interview. Experienced interviewers asked the survey questions and also the questions which were to be used for identifying the correct respondents in large firms. Answers were noted, as were any difficulties in responding and in dealing with the survey instructions. As a result of this work, some questions and instructions were modified.

The survey system was tested and modified before the interviewers from the Regional Offices were trained in its use. Modifications were also made in the early stages of data collection, which was treated as a pilot test of the full system.

5. DATA COLLECTION

5.1 The Problem of Complexity

The Innovation and Technology Survey covered eight topics, most of which were complex. Experience at Statistics Canada showed that the questions were not suitable for the standard printed questionnaire, mailed out and mailed back with telephone or mail follow-up. Neither were the questions suitable for computer assisted telephone interview (CATI) and resources were not available for on-site interviews. To reduce the burden on individual respondents and to ensure that the appropriate respondents were found, a system was used which combined a CATI approach with mailed questionnaires and telephone follow-up.

5.2 The System

A single PC-based system was used to manage the survey. It provided screening questions to telephone interviewers, controlled the interviews and captured the data, printed questionnaires and covering letters tailored to the respondents identified during the telephone screening, and controlled all related information flow, follow-up, and data capture. The system was designed by A.B. Sunter Research and Design & Analysis Inc. and the combination of the system and the use of experienced interviewers in the Regional Offices of Statistics Canada resulted in a response rate of 89%.

The system was used principally to identify the correct respondents for the various parts of the survey. However it also had the capability for a second set of screening questions in which the identified respondents could be asked whether they could answer certain types of questions or not. This is a potentially powerful tool for future surveys as Canadian record keeping is not uniform and some firms are able to respond to questions on training expenses, for example, by reference to their accounts, whereas others would have to guess at the answer. If, in the opinion of the respondent, a question was difficult to answer accurately, the interviewer could remove questions on that subject from the questionnaire that would be printed and mailed at the end of the interview.

5.3 Multi-plant Firms

The sample was drawn at the level of the plant and the task of the telephone interviewer was to find the name of a person who could report for the selected plant or plants. The interviewer

also asked for a person, or persons, who could respond at the level of the firm, for those questions which only made sense at that level.

If no one could report for the selected plants, or if the plants had ceased to operate, the interviewer was able to substitute any of the other plants of the firm and seek an appropriate respondent. To facilitate this, all of the plants of the firm, and the structure of the firm, as taken from the Business Register, were provided to the interviewer by the system. If the structure of the firm had changed since it had been last up-dated on the Register, the system allowed the interviewer to alter the structure.

The support system ensured that plant-level questions on technology were reported for a specific plant or plants. By asking about a specific plant, the problem was avoided of the average response encompassing all plants in the firm. It was also important to identify the right person to answer the question. In previous Statistics Canada surveys of technology use [9], care was taken to identify the respondent, however there was no built-in capacity to verify that the information given was for the plant specified and neither was there a capability to substitute an alternative plant as part of the interview. The support system for the Innovation and Technology Survey dealt well with both respondent and plant identification.

5.4 Follow-up

The system controlled the follow-up which was made more complicated by the variety of printed questionnaires. All firms received general questions, small firms received either a technology or an innovation questionnaire, and the questionnaires, and their length, received by large firms depended on the respondents identified.

5.5 Response Rate

The response rate was the total number of complete and partial returns, divided by the number of plants in the sample reduced by the number of plants which were known to be no longer operating, those which were seasonal, and those which could not be contacted. When data collection ended on March 31, 1993, the response rate for all Canada was 89%. With late responses, it may rise slightly.

During the data collection, response rate was monitored for each of the participating regional offices and a minimum of 75% was set as a target. All regional offices exceeded this target and the highest was 96%.

6. ANALYSIS OF PROBLEMS

After data collection was completed, the interviewers and their supervisors in two regional offices were asked for the problems that they found in conducting the survey. This information was retained for the analysts working with the data and for the design of future surveys on innovation and technology.

Of general interest was the problem in getting response to questions on impediments to innovation and to the acquisition of technology and also problems with long questions requiring subjective analysis. Some questions, such as those on research and development, also had a low response, but that was to be expected from the fact that fewer than 4% of Canadian firms in manufacturing do research and development, as defined in the Frascati Manual [10].

7. CONCLUSION

A survey, which should provide answers to questions necessary for public policy analysis, has been designed and put in the field and the data collected with considerable success. In doing this, a computer-system has been used which permits most of the concerns raised in the Oslo Manual to be met without high cost.

The next stage for the Innovation and Technology Survey is the analysis of the data from the survey and along with data from other surveys of Statistics Canada and from administrative sources. While this will provide the sought after information for policy analysis, there is a longer term benefit from the survey.

As a result of conducting the survey, there is now a set of questions on innovation, not requiring on-site interview, and tested in a Canadian context. From these questions, an innovation module can be developed for inclusion in on-going surveys of the production of goods and services, or related surveys of research and development. There is precedent for this in the R&D module in the Model Survey of Computer Services [11]. This survey was developed by Statistics Canada in consultation with the Voorburg Group and adopted by the Statistical Commission of the United Nations for use by members. If the whole process of technological innovation is to form part of the survey activities of statistical agencies, this is a necessary next step.

As Innovation and Technology Survey has overlap with the EC/OECD questionnaire for innovation, and also with U.S. surveys of technology, a direct benefit of this work will be international comparisons with the growing body of survey results on innovation and technology.

8. MORE INFORMATION

Survey results will be released during 1993 in publications of Statistics Canada. Anyone interested in more information is invited to contact John Baldwin (613-951-8588, FAX 613-951-5643) or Fred Gault (613-951-2198, FAX 613-951-9920).

REFERENCES

1. Statistics Canada (1993), The Canadian Innovation and Technology Survey: Survey Questions, Services, Science and Technology Division, Ottawa, April.

2. D.P. DeMelto (1980), Preliminary Report: Innovation and Technological Change in Five Canadian Industries, Economic Council of Canada Discussion Paper 176, Ottawa.

3. OECD (1992), OECD Proposed Guidelines for Collecting and Interpreting Technological Innovation Data, "OSLO Manual 1992", Paris.

4. OECD (1992), Technology and the Economy: The Key Relationships, Paris.

5. R.C. Levin, A.K. Klevorick, R.R. Nelson, and S.G. Winter, "Appropriating the Returns from Industrial Research and Development", Brookings Papers on Economic Activity, 3:1987, pp. 783-820.

6. R. Nelson, A Description of the Yale2 Survey, International Seminar on Technological Appropriation, INSEE, 9-10 June, 1992, Paris.

7. Consumer and Corporate Affairs Canada (1989), Survey of Intellectual Property Rights in Canada: Final Report, Ottawa, March.

8. U.S Department of Commerce, Bureau of the Census (1989), "Manufacturing Technology 1988", Current Industrial Reports, Washington, May.

9. L.M. Ducharme and F.D. Gault, "Surveys of Advanced Manufacturing Technology", Science and Public Policy, Vol. 19, No. 6, 1992, pp. 393-399.

10. OECD (1981), The Measurement of Scientific and Technical Activities: Proposed Standard Practice for Surveys of Research and Development - "Frascati Manual", Paris.

11. United Nations Statistical Office (1991), A Model Survey of Computer Services, Statistical Papers, Series M, No. 81, New York.

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