PERSONALIZED QUESTIONNAIRES FOR CANADA'S ANNUAL SURVEY OF MANUFACTURES

John S. Crysdale, Statistics Canada
13-C8 Jean Talon Building, Ottawa, Ontario, Canada K1A 0T6

"Nothing," replied the artist, "will ever be attempted, if all possible objections must first be overcome."

Samuel Johnson (Rasselas)

Abstract:

This paper describes the personalization of the long-form questionnaires of Canada's Annual Survey of Manufactures (ASM). Personalization was motivated by the desire to reduce respondent burden. Prior to personalization, long-form questionnaires were the same for all the establishments of a given 4-digit SIC industry. Each questionnaire contained a list comprising almost all the commodities likely to be used as inputs or produced as outputs by that industry. For the typical establishment, only a small subset of the commodities listed was applicable. Personalization involved tailoring those lists to each individual establishment, based on the previous reporting of that same establishment.

After first defining terms and then providing some quantification of the need for personalization, the paper details a number of the prerequisites—an algorithm for commodity selection, a set of stand-alone commodity descriptions, and an automated questionnaire production system. The paper next details a number of the impacts of personalization—and does so in terms of response burden, loss of information, and automation. The paper concludes with recommendations and a summary.

1. Terms and Notes:

Canada's Annual Survey of Manufactures (ASM): this is a survey that collects and publishes principal statistics and commodity data for 35,000 Canadian manufacturers.

Personalized questionnaires: these are questionnaires on which the questions asked of a business are based on the previous reporting of that same business.

Extent of ASM personalization: this involves the sections of the long-form questionnaire relating to input and output commodity detail. More specifically, the personalized sections cover raw materials purchased, containers purchased, and products shipped. (In 1993 and 1994, personalization also included the fuel and electricity section of the long-form. However, since that section had originally comprised fewer than a dozen commodities, reverting to full prompting was judged to be more helpful than burdensome. No longer personalized, the fuel and electricity section is excluded from the data presented in this paper.) From 1993 to 1995, the long-forms of selected manufacturing industries were used for a pilot test of personalization. In 1996, personalization was extended to the long-forms of all manufacturing industries. Typically, long-forms have accounted for over 90% of manufacturing shipments.

Pre-specified commodity lines: these appear on the questionnaire to request data for specific commodities. The descriptions of the subject commodities are pre-printed on the questionnaire (along with a commodity code and, often, a unit of measure for quantity data).

Write-in commodity lines: these appear on the questionnaire to collect data for all commodities which have not been covered by pre-specified lines. For these, the respondent supplies a commodity description (and may also supply a commodity code and unit of measure). Write-in lines take the general form: *All other products shipped (specify main items separately).* A given write-in line can be used to report multiple commodities—as a result, the number of lines used by (i.e., reported by) a given establishment can exceed the number sent to (i.e., asked of) that same establishment.

2. Why did the ASM Personalize?

Before personalization, ASM commodity questions were asked by sending all the establishments in a given industry identical lists of likely-to-be-reported commodities. Such standardized lists were often long—and large portions were not applicable to the typical establishment.

The worst case—the questionnaire for Other Machinery and Equipment Industries—contained 354 commodity lines (328 pre-specified lines and 26 write-ins). The output section alone contained 241 commodity lines and ran for ten 8x14 pages. Over 500 establishments received

this questionnaire. The typical recipient used only 13.1 commodity lines (of which 11.5 were pre-specified lines and 1.6 were write-ins).

Table #1 summarizes the *overall* situation in 1992—the year before personalization began for a group of pilot industries.

The group labelled *Pilot Industries* covers the industries used in the pilot test. These comprised Transportation Equipment Industries, Chemical and Chemical Products Industries, Office, Store and Business Machine Industries and Other Machinery and Equipment Industries. The group labelled *Other Industries* covers all manufacturing industries that were not part of the pilot.

The data are a simple average of the count of commodity lines listed on the questionnaire and a simple average of the count of lines completed by respondents.

The data show that the average establishment was sent 99.1 commodity lines and used 11.0. The average pilot establishment received 190.4 lines and used 13.8; the average other establishment received 83.1 and used 10.5.

Table #1
Before Personalization
Average Number of Commodity Lines, 1992

	Sent	Used
Pilot Industries	190.4	13.8
Other Industries	83.1	10.5
All Industries	99.1	11.0

Such long and largely inapplicable lists were seen as a considerable source of response burden. Reducing that burden was the reason for personalization. Sometimes this is described as reducing *perceived* burden since there is no reduction in the amount of data actually requested. However, especially for the much longer questionnaires, it was time-consuming to locate the relevant commodity lines in order to complete the form—and the burden was therefore quite real.

3. Prerequisites for Personalization

3.1 Commodity selection algorithm

Personalization required that there be an algorithm for selecting the commodities that would appear on personalized commodity lists. From the beginning the intent was to list only commodities that had actually been reported in previous years. There was to be no attempt to include commodities deemed to be *related* to those actually reported. Algorithm development, therefore, focused on determining how many previous years' reporting should be used when generating personalized commodity lists. Tests were conducted to predict what would be reported in an already-completed year using data from even earlier years. The tests looked at the percent that was missing when different numbers of prior years were used as predictors. The tests also looked at the percent inapplicable. On the strength of those tests, it was decided to use just the previous year. Selected commodities would be followed by space for respondents to write-in additional items.

Commodities generated by estimation routines are also included on personalized commodity lists. Estimation occurs in the event of non-response and, in most cases, is based on earlier reporting by the non-responding establishment. In some cases, estimation is based on industry-level information.

There also had to be an algorithm for dealing with establishments that did not have previous commodity detail—reported or estimated. Such establishments are mainly new businesses (births) and conversions from questionnaires without commodity detail (pseudo-births). Before personalization, such units were sent the same questionnaire as ongoing businesses. Under personalization, the solution adopted was to send a list of the most frequently reported commodities in the corresponding industry or group of industries from the previous year, followed by space for write-ins. Adopting this top-commodity algorithm resulted in establishments without previous detail within the pilot group being asked 53.0 lines in 1995, compared to 206.1 lines in 1992. Because the resulting questionnaires are common for each industry—rather than being personalized at the establishment level—they are outside the scope of this paper. Such establishments accounted for 2% of manufacturing shipments in 1995. The precise details of this algorithm were modified in 1996.

3.2 Stand-alone commodity descriptions

Personalization, implemented on a commodity-level basis, requires that each commodity be described in a fashion that can be understood in the absence of the surrounding hierarchy of the commodity classification. If only one commodity is listed on the questionnaire, the description has to make clear what it is that is being requested. Such descriptions are referred to as *stand-alone*.

As of 1992, long-form commodity lists described commodities in a hierarchical fashion often with a heading.

For example, in SIC 3261 Railroad Rolling Stock Industry, under the heading *Covered and closed*, the following three commodity codes and descriptions appeared:

8606.91.11   Box – vehicle parts
8606.91.12   Box – newsprint
8606.91.19   Box – other

These descriptions are not stand-alone. First, it is not clear that any of the descriptions refer to railway cars (even with the heading). Second, the use of the word *other* requires an explicit statement of what it is that is being excluded.

On a stand-alone basis, these three descriptions became:

8606.91.11   Railway cars, box, for vehicle parts

8606.91.12   Railway cars, box, for newsprint

8606.91.19   Railway cars, box, other than for vehicle parts or newsprint

Creating stand-alone descriptions across all long-forms required dealing with over 5,000 different commodity classes. Descriptions were developed in both English and French. This work involved all subject matter staff. As a result of this work, commodity descriptions are now standard across manufacturing industries and across the input and output sections of the questionnaire.

Some stand-alone descriptions became quite lengthy. Typically, it was residual categories that were involved. If the description became too long to be of practical value on a questionnaire, the subject commodity was not pre-specified but was left to the respondent to report as a write-in.

An alternative to stand-alone descriptions would have been to maintain commodity blocks of the sort existing in 1992 and print the whole block, complete with a write-in section, any time one of the component items was reported by the respondent in the previous year. This option was not pursued since it would have been overly complex and would have added to questionnaire length. And, the block itself would have to be made stand-alone.

3.3 Automation

Personalization also required that questionnaire production be automated to a much greater extent. Before personalization, automation was limited to the fact that a camera-ready copy of the master questionnaire was produced by a word-processing package. Greater automation was necessary in order to retrieve previous year commodity data for large numbers of establishments and then to include that information, integrated with current year identifiers, on the personalized questionnaire.

Considerable printing power was also required in order to print large volumes in a short time period. In the case of the ASM, printing involves close to 200,000 pages, every page different, in duplex mode, in the space of a few weeks.

Personalization required that editing staff be able to view copies of the mailed questionnaires on their desktop PCs. This requirement is referred to as *on-screen viewing*. Underlying this was the need for editing staff to know exactly what was asked on the questionnaire when talking to a respondent. Before personalization, editors just kept blank copies of each standard questionnaire. Keeping hardcopies of all personalized questionnaires was out of the question, hence the requirement for on-screen viewing.

4.   Impacts of Personalization

4.1 Response burden

The rationale for personalization was to reduce response burden by shortening the commodity sections of the long-form questionnaire to the lines that are relevant to each establishment. There are two components to this: (1) reducing the number of lines sent, and (2) keeping them relevant.

The number of lines sent on pilot questionnaires has, in fact, been reduced. Table #2, shows that the average number of lines sent to the pilot group fell sharply between 1992 and 1995. For that group, the number fell from 190.4 in 1992 to 14.5 in 1995.

The number sent to the other group also fell somewhat. This is mainly the result of other questionnaire initiatives. Those initiatives involved reducing the number of write-in areas to one per commodity section (this also affected the numbers sent to the pilot group) and eliminating pre-specified lines for which no data had been reported for several years.

Table #2
Before and After Personalization
Average Number of Commodity Lines, 1992 and 1995

		1992		1995	
		Sent	Used	Sent	Used
Pilot Industries	Pre-specified	176.4	10.9	11.5	10.4
	Write-in	14.0	3.0	3.0	1.7
	Total	190.4	13.8	14.5	12.0
Other Industries	Pre-specified	73.9	8.6	68.9	8.0
	Write-in	9.2	2.0	3.0	1.9
	Total	83.1	10.5	71.9	9.8
All Industries	Pre-specified	89.2	8.9	60.6	8.3
	Write-in	9.9	2.1	3.0	1.8
	Total	99.1	11.0	63.6	10.2

The lines listed on pilot questionnaires have also been kept relevant. Relevance involves having a large correspondence between pre-specified lines sent and used and keeping the need to report write-ins to a minimum.

Table #2 shows that, in 1992, 10.9 of the 176.4 pre-specified lines sent to pilot respondents were used by those respondents—an applicability rate of only 6%. In 1995, the number used was 10.4 of 11.5 sent—an applicability rate of 90%. For the other group, the applicability rate was 12% in both 1992 and 1995.

Table #2 also shows usage details for write-in lines. Write-in usage declined considerably for the pilot group and did so slightly for the other group.

One reason that the number of write-in lines used would decline for the pilot group is that personalized questionnaires prompt respondents with *all* commodities reported in the previous period—even if written-in— provided a description exists and the class is still valid within the commodity classification. This reduces the need for commodities to be written-in by respondents from what it otherwise would be. By contrast, for the other group, written-in commodities only appear on the following year's questionnaire if they have been

specifically added to the pre-specified group by subject matter staff. In 1995, an average of 2.5 of the pre-specified pilot industry lines were automatic prompts from previously written-in lines (and average usage of these was 2.0 per establishment).

Other reasons why pilot industry write-in usage would decline are given in the section on information loss.

4.2 Loss of information

Between 1992 and 1995, the number of reported commodity lines fell, both for the pilot group and for the other group. For the pilot group, the relative decline was twice what it was for the other group. It seems clear that some information loss has occurred. It is unlikely that this represents a sudden, disproportionate, shift in specialization.

Some decline was expected to occur as a result of personalization. Without the prompts of a larger commodity list, respondents will sometimes fail to provide complete commodity information. The prompts serve as a reminder and as an indicator of the statistical agency's interest. Some activity will be excluded

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altogether. Other activity will be forced, inappropriately, into whatever classes already appear on the questionnaire. An additional factor which can contribute to the decline in numbers of commodities relates to the editing procedures. Telephone follow-up on poorly-specified write-in lines is done only for larger-valued commodities in the more critical establishments. Otherwise, where write-in lines are poorly specified, they may be grouped together and assigned to a single commodity class before being data-captured. The impact of this factor cannot be isolated without examining the original, completed, questionnaires. This factor may be more significant for the pilot group for which there are fewer pre-specified lines.

Has information loss been significant? Table #3 suggests that such loss has *not* been significant. This table is constructed by excluding, from the data for any given establishment, any commodity line for which the value reported by that establishment is $100,000 or less. (When taken in aggregate, the lines excluded by this process account for half of one percent of aggregate commodity values in 1992, and less than that in 1995.) The table shows that, when these lines are excluded, the pilot group and the other group are each virtually unchanged between 1992 and 1995.

Table #3
Average Number of Commodity Lines
Eliminating Smaller-Valued Lines Reported

	1992		1995	
	Sent	Used	Sent	Used
Pilot	190.4	8.2	14.5	8.1
Other	83.1	6.3	71.9	6.2
All	99.1	6.5	63.6	6.4

Has personalization resulted in more activity being classified as *Commodities, not elsewhere specified*? Between 1992 and 1995, more activity was coded to the residual class by both groups. The increase was smaller for the pilot. For that group, the share of the residual class was 0.2% in 1992 and 0.3% in 1995. For the other group, the shares were 0.3% and 0.5%.

Has personalization resulted in a reduction in the level of detail collected? By way of background, ASM commodities are classified using an extension of the Harmonized Commodity Description and Coding System (HS). Under that classification, commodity classes are assigned codes ranging in length from 2 digits to 9 digits. The more detailed the class, the greater the number of digits. Between 1992 and 1995, for both the pilot group and the other group, there was some decline in detail—as measured by average numbers of digits and weighted by shipments. For the pilot group, average detail declined slightly, going from 6.7 digits to 6.6 digits. However, for the other group, the decline was somewhat greater—a drop from 7.1 digits to 6.8 digits.

In order to reduce the extent of detail loss arising from personalization, two modifications were made to the commodity selection algorithm; these took effect in 1996.

First, a *must-ask* facility was incorporated into the algorithm. When a line is specified as must-ask for a given industry, it will appear on all personalized questionnaires within that industry—regardless of past reporting. Must-ask lines can be used to explicitly ask for information on products of particular interest. For example, must-ask lines might be used in cases where the activity of interest is covered by newly-created commodity classes or where the activity is sufficiently important that it is undesirable to risk having any part it, however small, reported in a residual category. Must-ask lines have also been used in a small number of cases to force entire blocks of lines to be listed just as they had been before personalization—this is helpful in situations where the total reported for a given commodity is also to be reported on a sub-divided basis—subdivided (say) by process of production.

Second, a *detail-forcing* routine was also incorporated into the commodity selection algorithm. This involves commodity lines that are about to be prompted, automatically, on the current year's questionnaire after having been written-in the previous year. If the about-to-be prompted commodity is too aggregated relative to the industry standard, a greater level of detail is forced. For example, if commodity class 8606.91.1 is about to be prompted, but the industry standard is actually to ask for 8606.91.11, 8606.91.12 and 8606.91.19, then the respondent would be prompted with the latter three codes, and not with the former, less-detailed code.

4.3 Automation

Increased automation of questionnaire production was a prerequisite for personalization. Increased automation also had a number of positive impacts.

As automation proceeded—it was all effected within the framework of the existing edit/storage system—it prompted a review of the questionnaire as a whole and this, in turn, led to the deletion of a number of

unnecessary industry-specific variants. The resultant increase in standardization—a move in a direction seemingly opposite to that implied by personalization—led to the consolidation of the underlying questionnaire templates. Consolidation reduced the number of templates from 163 to 28. This made them easier to administer and imposed a greater uniformity on ASM output.

Automation also meant that questionnaire printing no longer involved bulk copying of blank forms—with the substantial over-runs that were inherent in that process. The over-runs were needed to allow for *re-mails* (additional copies of the questionnaire, sent at a later date at the request of the respondent). Questionnaire printing is now done strictly on an as-needed basis. This has greatly reduced the amount of paper waste.

Automation also permitted existing non-commodity questions to be selectively turned off in order to reduce unnecessary response burden; and it facilitated the selective addition of new questions.

Automation also provided an opportunity to change the page size from 8½ by 14 inches to 8½ by 11 inches. The latter is considered easier to work with. This change also helped put an end to the practice of folding questionnaires prior to mailing—a practice which required that questionnaires be kept sorted by thickness in order to facilitate their flow through the folding machine.

5. Recommendations

1. To reduce the extent of information loss, the ASM should consider increasing the number of commodities listed on personalized forms. Even with a doubling of the number of commodities, questionnaires would still be just a fraction of their original length. There are a number of ways to go about this. One way is to use more previous years' data when generating personalized lists. Another is to send a standardized list as part of the questionnaire package—this would help ensure complete, high quality write-in information. Such lists could also be used as an alternative to the *must-ask* facility, described earlier, which is used to gather information on items of particular interest, including so-called *emerging commodities*.

2. To obtain useful input on personalization, the ASM should consider contacting respondents to get their reaction to the new approach and to solicit ideas for improvement. Such work should also include the development of detailed data on response rates, turn-

around time, completion time and the extent of follow-up.

6. Summary

- The objective of personalization was to reduce response burden.

- Personalization reduced the number of commodity questions on the typical pilot industries' questionnaire by over 90%—the number asked is down from an average of 190.4 in 1992 to an average of 14.5 in 1995.

- Instead of sending each establishment a standardized list of commodities, each is sent a list based on its own previous year's reporting.

- As expected, there has been some loss of information.

- That loss does not appear to be significant.

- Personalization forced the automation of the questionnaire production system; this has had numerous positive consequences.

- In reference year 1996, personalization was extended to the long-form questionnaires of all manufacturing industries.