

The Use of Electronic Reporting and Other Electronic Tools for Data Providers

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Abstract

Electronic reporting has become a viable reporting solution for data providers in business surveys and censuses. For this reason, the U.S. Census Bureau has aggressively expanded the use of electronic reporting for its economic surveys and censuses. The Census Bureau has also improved tools to assist respondents. It improved its Business Help Site (BHS) to assist data providers in managing their data reporting and to improve response rates. The BHS is vital in three major areas: information, communication, and confidential transactions. Respondents can communicate confidential information electronically through the Secure Messaging Center (SMC). The Census Bureau created the SMC to provide secure email capabilities. The use of electronic reporting and these other electronic tools help reduce respondent burden and give respondents flexibility to manage their time to complete a survey or census. Electronic reporting also improves data with built-in edits that check respondent entries. We will describe how the use of electronic reporting and other electronic tools assist respondents as well as improve the timeliness of data processing and data quality.

Key Words: Electronic response, e-filing, economic surveys, response strategies

1. Introduction

Over the past five years, the Economic Programs Directorate at the U.S. Census Bureau has witnessed significant increases in electronic filing (also referred to as e-filing), from businesses selected to report in their programs. The directorate conducts current economic surveys – that is, programs conducted on a monthly, quarterly and annual basis – and an Economic Census, which occurs every 5 years²

The surge in electronic reporting is the result of expanding the availability of e-filing, designing better web-based questionnaires, and leveraging the ubiquitous nature of the Internet in communicating and providing information quickly to data providers. From an organizational perspective, e-filing provides advantages over more traditional modes of collection. It results in better data quality, reduced program costs when it becomes the dominant mode of response, and getting faster response compared to traditional

¹ Any views expressed are those of the author(s) and not necessarily those of the U.S. Census Bureau.

² The Economic Programs Directorate at the U.S. Census Bureau conducts more than 75 programs that measure and profile economic activity of business and government entities. These programs cover a variety of sectors and are conducted with different frequencies – from monthly, quarterly, and annual frequency to the 5-year cycle associated with the Economic and Government Censuses. In addition, a comprehensive set of foreign trade statistics is released monthly based on a rich set of administrative records. This paper focuses on the economic surveys and census, which target the business population.

paper-based collections. Additionally, it provides survey managers with more readily available information about the response process (e.g., paradata).

Moving forward, the Economic Programs Directorate is looking strategically at the role that paper collection will play in the context of e-filing. This paper describes the electronic reporting for business programs, the associated electronic tools that support e-filing, examples of quality metrics to evaluate e-filing and strategies for moving forward.

2. Electronic Reporting Progress over the Last Five Years

While the Census Bureau has experimented and used a variety of electronic reporting methods over the past 30 years³, our discussion point starts in 2007. Since that time, e-filing has evolved into an effective mode. The strategy for e-filing has been different for economic current surveys versus the Economic Census and related programs. We, therefore, discuss these approaches separately below.

2.1 Electronic Reporting for Current Surveys with Centurion

Five years ago, a handful of economic programs offered e-filing via web reporting. The Census Bureau had a generalized instrument called Census Taker. Only a limited number of surveys used this system, as survey managers had to prepare a business case and receive senior management approval to e-file. At that time, data received via electronic response made up a small percentage of total response. Costs to develop new web reporting applications could not be justified, unless surveys were in sectors likely to e-file, thus getting a priority. For example, manufacturing plants were less likely to report on-line than those businesses in services sector industries. Additionally, a couple of these initial surveys on Census Taker started out as Computer Self-Administer Questionnaires (or CSAQ's), where the Census Bureau mailed CSAQ instruments to respondents with data sent back via mail or transmission through the web. The progression of these surveys to direct web applications made sense as it eliminated the manual handling of diskettes, CD-ROM's and other devices.

Approximately four years ago, the Census Bureau replaced its legacy Census Taker Internet reporting instrument with a more robust and modern online reporting instrument called Centurion. Centurion is highly flexible and supports a myriad of collection inquiries across multiple independent surveys. With the Census Taker system, changing the instrument to meet sponsor needs was difficult because of the programming approach used for generalizing collection instruments. Census Taker's approach was providing tools that let non-programmers build and develop on-line instruments, resulting in the creation of very basic instruments. An open architecture supports Centurion, and modern development tools, such as Java, enable the development of more usable and flexible instruments. Given the continual and creative change with the Internet, keeping up is hard under any circumstance. With Centurion, the ability to add features is much easier.

The Centurion application and any response data are located on Census Bureau web servers. Centurion operates behind the Census Bureau's firewall using secured interactive web pages. Centurion is software built specifically to fulfill the Census Bureau's requirement to securely collect and distribute sensitive information over the Internet. It encrypts sensitive information in transit (on the Internet) and stored on web servers; monitors web services; and regularly tests for any potential security issues.

³ A few large companies submitted data by tape in the late 1970's and early 1980's.

With Centurion, the Census Bureau has aggressively expanded the use of web-based reporting for its Economic Programs (in addition to expanded use across demographic programs). Today 35 economic area current surveys offer web-based reporting through Centurion, compared to five at its initial use four years ago. Table 1 shows the proportion of forms received electronically based on the check-in rates⁴ for selected economic current surveys, with surveys showing increases in e-filing over the past five years. In addition, more frequently conducted surveys show a higher uptake than annually collected programs.

Table 1: Percentage of Forms Received Electronically to Total Forms Received: Selected Surveys*

Survey	Frequency	2007	2008	2009	2010	2011
Annual Capital Expenditures Survey	Annual	37.4	45.0	40.6	42.3	
Annual Wholesale Trade Survey	Annual	26.0	32.0	46.0	60.0	
Business R&D and Innovation Survey	Annual	13.1	43.6	51.0	57.6	
Information and Communication Technology Survey	Annual	42.0	50.0	52.0	52.4	
Manufacturers' Shipments, Inventories, and Orders	Monthly**	24.0	26.3	45.8	61.2	68.4
Manufacturers' Unfilled Orders Survey	Annual***			36.9	41.3	
Medical Expenditure Panel Survey	Annual			8.9	11.0	14.0
Monthly Wholesale Trade Survey	Monthly				36.8	48.3
Quarterly Financial Report	Quarterly	54.0	53.4	59.5	64.7	66.1
Quarterly Survey of Plant Capacity Utilization	Quarterly		42.7	54.7	60.3	65.7
Quarterly Services Survey	Quarterly	43.6	50.6	53.3	58.7	67.1
Service Annual Survey	Annual		34.7	45.9	55.2	
Business and Professional Classification	Quarterly				40.4	50.5

*Source: Check-in Reports from Current Program Areas, Economic Programs Directorate, U.S. Census Bureau, internal documents.

** Note, monthly programs are averaged to represent the year.

***Shaded areas indicate final rates are not available.

For most surveys, electronic returns as a percentage of total returns have increased over the last several years, with many exceeding 50 percent of total forms received. Since 2007, the Business R&D and Innovation Survey (BRDIS) and the Manufacturers' Shipments, Inventories, and Orders Survey (M3) increased the highest, up 44.5 and 44.4 percentage points, respectively. M3 showed the highest (68.4) percent of electronic returns as of 2011.

2.2 Electronic Reporting for the Economic Census and Related Programs

For the Economic Census and related establishment surveys, the Census Bureau offers electronic reporting via downloadable software called Surveyor. Surveyor provides three electronic methods by which respondents can file: a CSAQ-like interactive questionnaire⁵, a workbook view, and a spreadsheet capability. Regarding the latter, data providers can create in the workbook a spreadsheet to export, complete, and then re-import to the software. Respondents then upload data from Surveyor to the Census Bureau site (via the Business Help Site, discussed in section 3.1). In addition to the Economic Census, other key establishment-based surveys use this software, notably the Annual Survey of Manufactures (ASM) and the Company Organization Survey (COS). These programs offer a different kind of complexity than economic current surveys.

⁴ The check-in rate is the proportion of forms returned to the total number "mailed."

⁵ The term CSAQ used here refers to an interactive questionnaire downloaded from the Internet to a respondent's personal computer for purposes of reporting.

First, there are roughly 550 questionnaire types associated with the Economic Census, and each questionnaire can be 12 to 15 pages in length. A metadata repository houses information to populate the questionnaires. For example, information such as questionnaire labels, wording, answer zones, and so on, are stored in an Economic Metadata Repository (or EMR). The EMR populates both the paper questionnaires and all the electronic formats available within the Surveyor software. Second, for the Economic Census, businesses complete a questionnaire for every establishment that they own. For large businesses with hundreds or thousands of establishments, the number of forms to be completed can be overwhelming. It is not feasible for these businesses to report on a questionnaire-by-questionnaire basis either by paper or by the interactive CSAQ instrument. For these businesses, the workbook or spreadsheet features of Surveyor are most conducive for reporting, where each establishment is a row of data on the spreadsheet. Respondents can extract spreadsheets from Surveyor and circulate them across their company to obtain data from various sources.⁶ Once completed, users import the spreadsheets into Surveyor, resolve issues based on edits using the workbook or CSAQ features, then upload and transmit their data back to the Census Bureau.

The ASM and COS programs also collect data at an establishment level. On the other hand, most current survey collections on Centurion tend to have reporting units at the company or broad business level.

The Census Bureau initially developed the Surveyor software for the 2002 Economic Census, and improved it for the 2007 Economic Census. Surveyor was the reporting option for all multi-unit companies and single unit companies that received the long form. As background, an Economic Census covers about 3 million single unit companies, with two million getting the long (or regular) form and one million getting a short classification form. These “classification” filers did not have the option of reporting electronically in either the 2002 and 2007 Economic Censuses.

Table 2 gives the 2007 Economic Census check-in rates. For 2007, the electronic check-in rate was 29 percent electronic overall. Establishments that are part of multi-unit companies had an electronic rate of 54 percent. Single units (long-form filers), however, showed only 3 percent electronically checked-in.

Table 2: 2007 Economic Census Check-In Rates*

	Check-in Rate	Percent Electronic
Overall (hit target)	86%	29%
Multi-unit establishments	91%	54%
From ~1,300 largest companies	96%	89%
Single unit establishments (long form)	81%	3%

*Source: Check-in Response Reports for Census Planning Meetings, Economic Programs Directorate, U.S. Census Bureau, internal documents.

Research with single unit companies after the 2007 Economic Census showed that they had a strong preference for web-based reporting.⁷ Reasons provided by these respondents include the belief that online reporting would be faster and easier. These single units could avoid downloading software and have the flexibility to access instruments any place -- from home or other locations at the worksite. Based on this information, for the 2012 Economic Census, the Census Bureau is developing a direct-Internet reporting capability for single units to report via Centurion. Both long form and classification form single units

⁶ See Sheldon, et al. (2007).

⁷ See Sheldon, et al. (2009).

will have this capability. Multi-unit establishments (companies with more than one location), however, will continue to report electronically using Surveyor. Like Surveyor, the direct-Internet reporting instrument for the 2012 Economic Census will utilize the Census Bureau's EMR. While much of the web pages are custom coded for the economic current surveys, Centurion has successfully rendered Economic Census web forms using metadata stored in the EMR database, thus creating an efficient process for assembling 550 electronic questionnaires.

3. Electronic Tools that Support E-Filing

The Census Bureau provides other electronic tools to support the work of the data provider. The Business Help Site (BHS) assists data providers, the Secure Messaging Center lets them communicate with Census Bureau staff directly, and the new Company Portal will help them manage their response burden.

3.1 Business Help Site

The BHS came about for the 2002 Economic Census. Today all survey programs use it. The BHS is vital in three major areas: information, communication, and confidential transactions.

The Census Bureau introduced the BHS to aid businesses in completing economic census and survey questionnaires. Respondents use the BHS to access electronic reporting software and for other on-line services, such as to request a time extension, to check their filing status, and to request a new set of questionnaires. Additionally, using the BHS, respondents can communicate via secure email with Census Bureau staff. To do this, the BHS links to a Secure Messaging Center (discussed in section 3.2).

The BHS also provides information about surveys, such as Frequently Asked Questions, an archive of current and historic form types, Census Bureau contact information, and a host of other items about programs.

In 2010, a cross-divisional team was formed to modernize the appearance and navigation of the BHS, which, among other things, brought the website up to current standards similar to other key sites hosted by the Census Bureau. The new design is more user-centric by trying to present information and search capabilities that let respondents find what they need in one or two clicks. In December 2011, the migration of all economic current surveys from the legacy BHS to the redesigned BHS was completed.

For more information on the BHS, refer to <http://econhelp.census.gov>.

3.2 Secure Messaging Center

Respondents can email confidential information electronically through the web-based Secure Messaging Center (SMC). The SMC is an offshoot of the BHS. Businesses wanted to communicate with Census Bureau staff, but emailing through our existing desktop software⁸ did not meet security requirements.

To accommodate the needs of businesses, staffs evaluated commercial off-the-shelf software for secure email exchanges, but the evaluation showed that none could meet our needs to distinguish different respondent emails across different program areas. Additionally, to meet security standards, the SMC had to be a "vault" approach; that is, users would access and post messages to a secure database rather than through regular email systems.

⁸ Census Bureau currently uses iNotes for E-mail capability.

Through this evaluation, usage of the BHS for secure e-mail became a viable solution. The BHS housed databases of information about respondents for each survey area. These databases provided information that respondents needed when they accessed the BHS to use electronic tools. These databases contained any “pre-listed” data for electronic instruments and other information to support on-line services. The existence of these databases allowed the BHS to extend its capability to be the “vault” to support an SMC environment.

The SMC allows survey respondents to communicate with their Census Bureau contacts by providing a means to exchange sensitive information in a secure environment. Title 13 and Title 26 of the United States Code and Census Bureau security regulations require the Economic Programs Directorate to safeguard confidential information in electronic communications with business respondents. Among the requirements are the following:

- Authenticating the identity of a respondent before engaging in electronic communication through respondent registration,
- Encrypting all messages and attachments, and
- Validating all attachments to documents as associated with a particular company.

We enhanced the SMC for the 2007 Economic Census, and then expanded it to include the economic current surveys. The number of economic current surveys utilizing the SMC has grown from nine in 2009 to 26 today, annually averaging 4,400 email exchanges.

3.3 Company Portal

The company portal provides another set of tools for the respondent. Linked to the BHS, the company portal lets respondents manage their filing requirement with the Census Bureau. While the BHS has general information about all surveys, respondents access electronic tools, on-line services, and secure messaging, on a survey-by-survey basis. On the other hand, the company portal gives respondents the big picture about all of their Census Bureau surveys. For companies that report in more than one program, the company portal allows these respondents to view and manage their total filing requirement. The model for the company portal is the banking model, where users can access through one site, all the information about their savings, checking, and other investments. Companies given access to the portal can see a list of surveys that they report in, the associated Census Bureau survey contact, the survey’s company contact, and the key dates for the surveys. We refer to this as the company calendar.

We envision a more mature interface for the company portal within the next 18 months. Eventually the calendar will link the respondent into the survey-specific Centurion tool without re-entering user ID’s and passwords. Through this portal, respondents will have access to other reporting aids and essential information associated with on-line services – for example, instant re-mail, and filing status. In addition, we would like to provide companies with the organizational structure we have for them on record, and ask that they ensure this structure is up to date. That is, they could update online their establishment locations, which could provide a direct feed into the business register – the universe frame of businesses at the Census Bureau. Other desired features include a file drawer of historic reports, something that is currently not available within the BHS. We see the portal as being a one-stop shop of information for companies managing their total filing requirement for Census Bureau programs.

4. Data Quantity and Data Quality of Electronic Receipts

Electronic reporting has increased efficiency in all phases of the Census Bureau’s operations. Real-time data edits incorporated into the electronic reporting software provide feedback to respondents to identify reporting errors, improving the quality of responses. Streamlined data processing has reduced the time necessary to make data available for analyst review to 24 hours, as compared to weeks for paper submissions.

4.1 Data Quantity

In terms of questionnaires checked-in, the quantity of electronic forms for the 2007 Economic Census was significantly higher than comparable electronic forms for the 2002 Economic Census as shown in Table 4.

Table 4: Number of Forms Received Electronically: 2007 Compared to 2002*

Description	2007	2002
Total Cumulative Electronic Forms by Count	877,676	476,196
Total Cumulative Electronic Forms As a Percent of Total Cumulative Forms Checked-in (Excluding Single Unit Classification Forms)	28.6%	16.0%
Multi-Unit Cumulative Electronic Forms Checked-in by Count	826,690	472,377
Multi-Unit Cumulative Electronic Forms As a Percent of Total Cumulative Multi-Unit Forms Checked-in	54.4%	35.1%
Single Unit Cumulative Electronic Forms by Count	50,986	3,819
Single Unit Cumulative Electronic Forms As a Percent of Total Cumulative Single Unit Forms Checked-in (Excluding SU Classification Forms)	3.3%	0.2%

*Source: Surveyor Improvements Team, “2007 Economic Census Electronic Receipts Quantity Analysis,” January 2009, internal report.

The increase in electronic receipts from the 2002 Economic Census to the 2007 Economic Census is the result of targeted outreach to large companies through the Account Manager Program; additional reminders to report; and software availability and improved functionality. The Account Manager Program assigns analysts to work directly with large companies to assist them in reporting; by explaining the information requested and helping them use the electronic reporting tools.⁹ The better than expected quantity of electronic receipts for the 2007 Economic Census played a part in the Economic Directorate spending less than planned on collection activities for the 2007 Economic Census.

At the end of data collection for the 2007 Economic Census, electronic forms accounted for 28.6 percent total forms returned compared to 16 percent in 2002. As noted before, the biggest surge in electronic forms was from multi-unit companies, who accounted for 54.4 percent. These multi-units accounted for most of the 877,676 electronic forms, which resulted in cost savings of \$1.6 million from the elimination of paper processing.

We expect further increases in electronic reporting in the 2012 Economic Census by providing higher quality Surveyor software; an infrastructure to handle large volumes of electronic submissions on servers around peak due dates; and direct web reporting for all single unit businesses (including classification filers). Additionally, we will promote e-filing by visibly placing websites on all materials, ensuring materials have an “e-filing” first message, and including a bright yellow e-filing flyer in the mailing packages – businesses cannot miss it. For incoming calls on 1-800 lines, and for reminder calling,

⁹ See Marske, et al.

telephone staffs will point respondents to electronic tools. Lastly, we will conduct a “letter-only” follow-up as a test.

A letter follow-up in a recent classification survey showed large uptake on e-filing. The classification survey updates the business register prior to the Economic Census mailout. The test covered 29,000 delinquents, where half received a form and letter and another half received a letter. Table 5 shows e-filing higher for the letter-only, even though overall response was not significantly different.

Table 5: Overall Response Check-in Rate by Mode*

	Letter-Only	Form and Letter	Significantly Different?***
Number of Valid Cases¹⁰	13,296	13,338	
Overall Response	34.19%	33.65%	No
Internet Response	23.83%	12.48%	Yes
Phone Response	2.99%	1.57%	Yes
Form Response	7.36%	19.60%	Yes

*Source: Marquette, E., “2012 Economic Census Evaluation Study #1 – Results of Letter-only Follow-up for Refile Single Unit Companies,” Internal research report, U.S. Census Bureau: April 2012.

**Significance at the 90 percent confidence level.

4.2 Data Quality

A review of electronic and paper returns from the 2007 Economic Census compared data quality between the two modes of collection. Quality in this instance references the ability of electronic and paper tools to collect actual reported data. The 2007 Economic Census respondents should have reported the following “must” data items: Months in Operation, Operational Status and Total Receipts (or Revenue).

Table 6 below shows the percentage of single unit (SU) and multi-unit (MU) paper and electronic records to report a value for the above data items. As the table shows, of those forms received electronically, the propensity to report values was higher among electronic filers.

Table 6: Percentage of SU and MU Paper and Electronic Records to Report a Value*

Data Item	Percent Value Reported				Percent No Value Reported			
	Electronic		Paper		Electronic		Paper	
	MU	SU	MU	SU	MU	SU	MU	SU
Months in Operation	92.77	99.83	72.38	54.46	7.23	0.17	27.62	45.54
Operation Status	99.96	99.99	77.61	56.55	0.04	0.01	22.39	45.45
Total Receipts	94.84	99.00	73.45	52.62	5.16	1.00	26.55	47.38

*Source: Surveyor Improvements Team, “2007 Economic Census Electronic Receipts Quality Analysis,” July 2009, internal report.

5. Future Strategies

E-filing provides the Census Bureau with many opportunities moving forward regarding the use of paper, the enhancement and development of better tools, and more digitized information to research respondent behaviors. Each is discussed below.

¹⁰ Invalid cases include cases that were returned as undelivered as addressed or out of scope.

5.1 Role of Paper Questionnaires

As we look to the future, it seems inevitable that e-filing will continue to grow, regardless of how much intervention there is on the part of the Census Bureau. One key objective is to evaluate the role of paper in an electronic reporting environment. It is clear that if respondents want to file by paper that capability needs to exist. The Census Bureau is currently developing a tool to allow respondents to print their own questionnaires from the web with the appropriate prelisted data (that is, name, address, prior year data, and so on). How we integrate this tool into the current production stream in a thoughtful way is the subject of our future research and experiments.

Many respondents continue to use paper questionnaires to guide them even though they opt to submit their form electronically. Sending these respondents questionnaires up front makes sense.

Internally, eliminating or reducing the paper preparation of traditional mail packages as well as the incoming processing of paper returns will reduce costs for the organization. Some programs have experimented with letters only for initial mailings in lieu of mailing packages. In some experiments for ongoing current surveys, the letter-only has replaced a follow-up. For recurring surveys, this may be more effective as respondents are conditioned to report and only need reminders. For programs such as the 5-year Economic Census, where company re-call of the program is low, the initial mailing packages do a lot to educate respondents about the program and their filing requirement. This message came out clearly in recent business climate surveys and focus groups with businesses about the 2012 Economic Census.¹¹

5.2 Enhancements to Centurion

We have opportunities to enhance Centurion over time. Plans are under discussion to perform a comprehensive review of Centurion to document and propose design requirements that identify best practices and foster quality and consistency across web-based surveys.

While Surveyor offers additional features than the web-based instrument, downloadable software has presented many challenges in the past few years. Many companies have migrated to tighter Internet security. About 5 percent of companies have trouble downloading software to their personal computers due to increased security of their Internet or personal computers. As a result, there is a need to contact technical staff for assistance.

The logical move to an all web-based approach for electronic reporting has numerous advantages. Downloading and installation of software by the respondent is not required. System requirements are minimal and primarily consist of a recent Internet web browser (capable of meeting current security/encryption standards at 128-bit encryption). All information entered on a Centurion web forms are stored securely on the server, and the Census Bureau's central IT staff continually keeps the software updated based on changing security standards. Even though it is a simpler application than the Economic Census, Centurion is producing spreadsheet formats for one current survey. The next logical step would be to expand Centurion to meet requirements for multi-units in the Economic Census.

5.3 Use of Paradata

Additionally, Centurion has the capability of capturing electronic paradata, where paradata refers to survey process data, such as the number of times a respondents accesses the HELP menu. Currently, this paradata is only "turned on" for a limited number of surveys. Some demographic surveys at the Census

¹¹ See WBA Market Research (2012).

Bureau have started evaluating the response process using electronic paradata. The Economic Directorate is conducting research and analysis of paradata collected from Centurion for the 2011 Annual Wholesale Trade Survey. Paradata offers many possibilities, such as reduced costs through improved questionnaires.

6. Conclusion

While e-filing has added quality and efficiency to survey processing, it has not added to the overall response rates for surveys. Surveys conducted with less frequency, show lower e-filing rates, though the rates are still strong. The electronic reporting and supporting tools have helped respondents and respondents have come to expect the offering of e-filing in any survey. The fact that e-filing continues to grow means that we now have to better understand what it will mean to be operating primarily from the web in all facets of our work, how in the future we can develop even more tools to substitute for the way we do work currently, and where paper will fit into future business needs.

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