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DIRECT DATA ENTRY USING TOUCH-TONE  
AND VOICE RECOGNITION  
TECHNOLOGY FOR THE M3 SURVEY  
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**ABSTRACT**

The use of the telephone and speech technology to allow respondents to directly enter survey or census data is one of the new technologies that the Census Bureau is studying in its search for less intrusive and more "friendly" methods of data collection. This paper describes the rationale for, and the assessment and operational process of, adding the telephone as a data collection device for the Manufacturers' Shipments, Inventories, and Sales (M3) Survey.

# **DIRECT DATA ENTRY USING TOUCH-TONE AND VOICE RECOGNITION TECHNOLOGY FOR THE M3 SURVEY**

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## **1.0 Introduction**

The Census Bureau (CB), the largest general-purpose statistical agency in the Federal Government, conducts hundreds of thousands of interviews<sup>1</sup> each year. This paper describes the rationale for, and the assessment and operational process of, adding the telephone as a data collection device for the Manufacturers' Shipments, Inventories, and Sales (M3) Survey. Before discussing our specific plans for the M3 survey, it is important to explain our motivations for searching out new data collection technologies and why we take the very deliberate experimental steps that are evident in the description of our testing program.

The greatest value of CB surveys is the time series nature of the data. Almost all CB surveys are repetitive, conducted on a monthly, quarterly, or annual schedule<sup>2</sup>. Data users, analyzing the economy, value the fact that the CB collects and publishes M3 Survey data monthly. The CB is also under continuing pressure to increase the accuracy and timeliness of its data. Technology, carefully applied, offers the potential to do both while containing or even reducing overall costs.

## **2.0 M3 Survey**

The M3 Survey is designed to measure the current industrial activity in the domestic economy's manufacturing sector and to provide an indication of future business trends. Monthly, 5 or 7 data items are collected from a statistically selected sample of U.S. manufacturers. The specific data items collected are: (1) For Durable Goods Manufacturers: Sales, New Order, Unfilled Orders, Total Inventory, Work-in-Progress, Finished Goods, Materials and Supplies, (2) For Nondurable Goods Manufacturers: Sales, Total Inventory, Work-in-Progress, Finished Goods, Materials and Supplies. This data is edited and adjusted

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<sup>1</sup>The term interview is being used in the broadest sense to include personnel interviews, telephone interviews, and respondent returned paper and electronic questionnaires. These interviews may or may not be computer assisted.

<sup>2</sup>In fact, the value of the Quinquennial Agricultural and Economic Census and the Decennial Census of Population and Housing is increased because they are done repeatedly.

estimates are calculated and released for each industry category in the domestic manufacturing sectors of the economy.

Because the M3 is a principal Federal Economic Indicator and the data are used in estimating the national accounts, it is essential that the data be very reliable. A significant factor affecting the quality of M3 statistics is the coverage rate for each industry. We recently received funding to improve the quality of the survey results by expanding the number of respondents in certain industry categories. Presently, companies respond to the M3 survey by either mail or fax but, because of limited resources, we place follow-up calls only to large nonrespondents. These calls are made by M3 survey analysts, who in addition to making such calls, also resolve edit failures and review M3 estimates for their assigned industries. If we are to significantly increase the coverage for some industries by expanding the sample or reducing the nonresponse and we cannot increase the number of survey analysts, it is essential to introduce more efficient and effective methods of collecting M3 data. In 1992, we will introduce two additional methods for collecting M3 data: respondent initiated telephone data entry (TDE)<sup>3</sup> and computer-assisted-telephone-interviewing (CATI).

Telephone data entry. TDE is used in a wide variety of applications, but it is a new concept for CB surveys. We believe it is compatible with the M3 Survey because respondents report only a few data items and they can report any time during a 24-hour day. We also expect TDE to improve the timeliness and accuracy of responses because we will not have to key data from a questionnaire, and the respondents will verify their answers. The needed hardware and software has been installed in a dedicated personal computer that is connected to a toll-free, long-distance line capable of handling four calls simultaneously.

The TDE-transmission procedure will be as follows:

- (1) Respondent dials the toll-free number,
- (2) The TDE hardware responds by providing verbal identification and requests the respondent to provide their 11-digit ID, (3) The respondent enters his/her ID either by using the telephone's keypad or by reciting the digits. The computer echoes the ID and provides the respondent an opportunity to correct it if it is wrong,
- (3) The computer-generated voice then requests the respondent to enter M3 data. This consists of the following sequence, which is repeated for each data item: (A) TDE request to enter particular data item, (B) Respondent replies either vocally or with the keypad, (C) TDE echoes the response and provides respondent an opportunity to correct the entry.

After all data has been entered, the TDE equipment will thank the respondent and then hang up the phone line.

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<sup>3</sup>Telephone Data Entry includes both data entry through voice response and keypad use

The only online editing being done is to verify the respondent's ID and ask the respondent to verify their data. Daily the TDE data will be up-loaded to the M3 processing system for editing.

Computer-Assisted Telephone Interviewing. We plan to use the CB's centralized CATI facilities to follow up selected M3 companies who do not respond by mail or fax. The CATI questionnaire, unlike TDE, will permit online editing--that is, if a response fails an online edit, the CATI software will instruct the interviewer to request clarification.

### **3.0 Evaluation Process**

The introduction of new technology can have both expected and unexpected affects on the data, the nonresponse rate and the ability to detect erroneous data, therefore it is essential that the introduction of any new process be accompanied with an evaluation plan that is capable of detecting and measuring problems. These factors impact heavily on how you introduce technology. The first factor (effect of technology change) implies that the use of scientific (experimental) designs are necessary to measure the effects of the technology. The second factor (nonresponse) causes the CB to try and use technology to "create" time to reduce nonresponse and bias. And the third (error identification) implies that the technology has to be smart, ie, have the capabilities to edit responses.

The evaluation of the new technology "TDE data collection" has two purposes: (1) is it successful for the M3 survey, and (2) should it be included in the Bureau's CASIC<sup>4</sup> program. CATI, already a part of CASIC, is being evaluated only as it relates to the M3 survey. The evaluation of new technology for inclusion in the CASIC program is a three step process: 1) assessment study, 2) small scale feasibility testing, and 3) operational testing.

#### **3.1 Assessment**

The assessment study is a review of the technology's literature and interviews with researchers, users and vendors to determine if the technology is appropriate for inclusion in the CB's CASIC program. Specifically, the Casic Committee for Technology Testing (CCTT), prepares a list of questions/issues to which the experimenter must consider and respond for the candidate technology. The M3 survey managers responded to the CCTT's questions, citing the knowledge already gained by the Bureau of Labor Statistics which shows that TDE can successfully be used to collect data in surveys that have a few data items.

#### **3.2 Small Scale Feasibility Studies**

Small scale feasibility studies occur when the CCTT, after reviewing the results of an

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<sup>4</sup> CASIC is an acronym for Computer Assisted Survey Information Collection and represents the entire set of integrated data collection tools available to Bureau survey designers.

assessment, decides that there is insufficient data about a technology to move directly to operational implementation. Testing can occur in a variety of environments, and most likely includes nonrandomized designs conducted outside of an operational survey activity. The small scale testing is designed to provide the necessary data for a decision on operational implementation. In this case, the survey manager decided and the CCTT concurred, to move directly to operational testing.

### **3.3 Operational testing**

The one major requirement for implementation is namely, an experimental plan designed to measure the impact of the new technology. As a first priority, the implementation plan should, if data differs between the old method and the new technology, shed light on the cause(s) for these differences. However, if this type of design is not feasible, the CCTT requires designs that measure the impact of the CASIC technology on the quality of the data. Direct and indirect indicators of survey quality that quantify accuracy, timeliness, and resource use must be produced. There are two general experimental designs which the survey manager is urged to consider. The first and preferred method involves: (1) Select a single additional sample, representative of the target population, (2) Introduce technology (TDE) and hold fixed, as much as possible, the survey instrument (questionnaire) and survey processing, (3) Measure the effects of technology on the survey, (4) Introduce better ways of doing the survey instrument or processing, to take advantage of new technology (TDE), (5) Measure again to see the effects of a new survey instrument or processing and to be able to separate technology's impact and new instrument or processing impact.

The second method involves: (1) Cutting out of the operational sample, two representative samples, (2) On sub-sample 1, introduce technology (TDE) and hold fixed, as much as possible, the survey instrument (questionnaire) and survey processing, (3) On sub-sample 2, introduce technology and introduce better ways of doing the survey instrument or processing to take advantage of new technology (TDE), (4) Measure before and after effects of new technology, new instruments, and new processing methods.

The second method generally is less accurate, but it can be more timely, cost less, and introduces less respondent burden.

What follows is a description of the three experiments to evaluate TDE and CATI. They are a combination of the two methods.

#### **Experiment 1**

Objective: Determine the willingness of existing, good reporting, M3 respondents to switch to TDE.

Experimental design. Request all companies in M3 industry 29B (petroleum refining) to report by TDE. No control group for this experiment, but we can compare reporting behavior before and after the switch to TDE. M3 analysts will call nonrespondents.

### **Experiment 2**

Objective: Determine the effectiveness of CATI follow-up in improving the response rates of small-company delinquents.

Experimental design. Before experiment starts, identify small company, poor reporters. The identified companies will be randomly assigned to either the treatment group or the control group. Companies assigned to the treatment group who do not respond by mail or fax, will receive a CATI follow-up call. Companies assigned to the control group will not receive a follow-up call.

### **Experiment 3**

Objective: Determine effect of combinations of TDE and CATI on quality of data received from new companies in the M3 survey.

Experimental design. This experiment will run 12 months and will have the following four treatments:

1. CATI follow-up only. Companies may only respond by mail or fax; nonrespondents will receive only a CATI follow-up call.
2. TDE only. Companies are sent a mailing at the beginning of the experiment consisting of (1) the M3 questionnaire instructions, (2) a 12-month file-copy of the questionnaire, and (3) information on how to use TDE. Each month, the companies are sent a TDE-reminder postcard.
- 3&4. CATI/TDE. Companies started out in CATI-follow-up mode and then switched to TDE. There will be two CATI/TDE treatments: one treatment with three months of CATI and the other treatment with six months of CATI.

## **4.0 Conclusion**

The M3 Survey telephone experiment will begin in February and continue for a year. Will the integration of the data collection and data capture processes via a device with which the respondent is comfortable, namely the telephone, result in higher response rates, reduced personnel and physical plant requirements, and reduced operating costs? These are the M3 questions that need to be answered. For our CASIC program, we will be trying to determine if Touch-Tone and Voice Recognition technology has progressed to where this data collection method should be made generally available to our survey managers/designers.



