IBM U.S. Federal

U.S. Census Bureau

Proposed Information Collection; Comment Request; Generic Clearance for the 2020 Census Field Tests

In Response to Request for Comment No: 2012-7431

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1 Introduction

IBM Corporation, U.S. Federal, (IBM) is pleased to comment on how the U.S. Census Bureau can contribute to the Department of Commerce effort to reduce paperwork and respondent burden by leveraging mobile technology for the 2020 Census Field Tests.

Mobility is one of the key technologies on which IBM is basing its future solutions. The others include analytics, cloud and security. As a technology leader, IBM also understands the changing landscape of the country, the evolving technology access and consumption patterns, and how the advances in mobile technology are shaping our future. Leveraging mobile technologies can play a critical role for the Census Bureau to succeed in meeting the objectives of efficiency, quality, and reduced burden. IBM understands the challenges of the U.S. Census Bureau in improving efficiency and quality of address and enumeration data, while continually reducing respondent burden and managing costs in the following areas:

- **Address Listing & Mapping** – Creating the Master Address File (MAF) involves more than understanding the basic postal addresses and mapping, but involves documenting rural routes, identifying group quarters, classifying non-city style addresses, identifying potential housing units through location descriptions, outdoor locations, and transient locations. Observation, investigation, reconciliation and documentation by field workers can be an extensive and expensive operation.
- **Field Enumeration** – During the 2010 Decennial Census, which was principally paper-based, the Bureau provided paper forms to respondents, and then sent field workers out for Non-Response Follow-up (NRFU) and Coverage Follow-up (CFU) interviews. The Census also provided telephone support for enumeration through the Telephone Questionnaire Assistance (TQA) and Coverage Follow-up (CFU) programs. As described by Dr. Groves, "The 2020 Census will be a multiple-mode census, using mail, telephone, internet, face-to-

face, and other modes as they emerge."[1] The addition of new modes will add new benefits and challenges to enumeration. One constant challenge for the Decennial Census will be to encourage responses from the public. Contact with respondents, verification of address locations, managing workload throughout the country, and providing a user-friendly survey accessible in multiple languages will need to be managed across multiple communication channels/modes (paper, telephone, web, chat and mobile). The Bureau will need to continually manage costs and burden on the public while developing, deploying and executing its multi-channel strategy.

- **Quality Control –** Quality is a key component in the collection and verification of Decennial Census data because it is used for important government and business decisions such as districting and funding allocation. Therefore it is critical to create efficient procedures and checks to verify address and location integrity, to verify previously collected data, to correct maps, and to verify housing units. Advanced analytics can be used to check the veracity of the data. High quality data collection and control activities need to be done in cost and time effective manners, supplementing the primary address and enumeration collection activities while adding positive value to the effort.
- **Security -** With the primary covenant of the Census being public trust, the Census Bureau takes great measures to enforce strict policies to ensure that the data collected for the purposes of the Census remain confidential and are used only for purposes of the Census to be in full compliance with Title 13 US Code Protection of Confidential Information. Evolving social technologies, web-based channels, and mobile platforms will pose security challenges for the Bureau to provide access to respondents and workers while remaining true to its security/privacy goals.

In order to meet the goals of the 2020 Census, IBM firmly believes leveraging a robust mobile strategy is necessary for the proper function

[1] Robert Groves, **CENSUS: LEARNING LESSONS FROM 2010, PLANNING FOR 2020, April 6, 2011, page 8**

of the agency and its mission. The information gathered from mobile devices and other technology will greatly benefit and reduce field efforts associated with address canvassing and field enumeration by reducing paper work and increasing the quality of data collected with the use of mobile GPS e.g. through the use of GPS tagging of new addresses. If the Census Bureau were to extend its mobile strategy to include respondent mobile devices, this could also increase response rate while reducing the costs of respondent support during short form capture. As more of the public becomes comfortable and reliant on mobile platforms as their primary communication device, the Census Bureaus mobile strategy will aid in the efforts of field workers who are already familiar with mobile technology by pairing the ease of use of tablet devices with automated GPS location technologies.

1.1 Document Overview

IBM's response/recommendations to the Bureau's Request for Comments are included throughout this document. Section 2.2 addresses mobile opportunities and the three areas described by the Bureau – address listing and mapping, enumeration, and quality control. IBM has recommended technology/tools related to mobile devices and applications that can be implemented in these areas to improve the Bureau's data collection field management functions. Section 2.3 discusses the challenges associated with the use of mobile devices and applications including security. Section 2.4 addresses other thoughts that IBM has regarding the 2020 Census that are not related to the use of mobile device and applications for field data collection. Recommendations within this section could significantly improve the quality and utility of the collected information as well as reduce the burden on respondents and potentially the Bureau.

Specifics are contained in the following document but overall comments on the four areas include:

(a) Whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information shall have practical utility – The

information obtained using mobile devices and applications will have the same utility and perhaps better accuracy than information collected from paper forms. Concerns regarding modal bias are discussed in Section 2.3.

(b) The accuracy of the agency's estimate of the burden of the proposed collection of information – IBM has no comments on this area at this time.

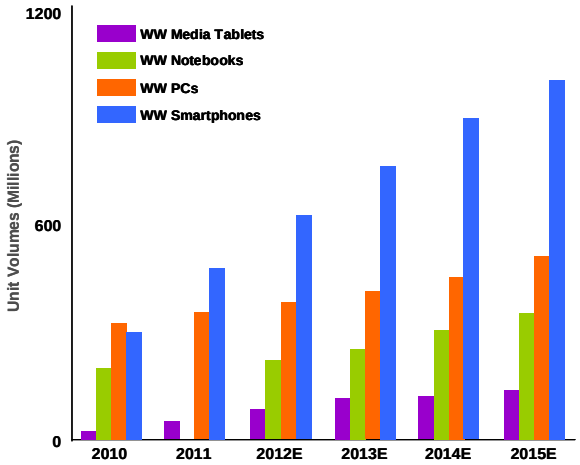
(c) Ways to enhance the quality, utility, and clarity of the information to be collected – Development of well-designed, analyzed and tested applications which lead to better outcomes is discussed within Section 2.2.3.1. More alternative approaches to the Census which would positively impact the collected information are described in Section 2.4.

(d) Ways to minimize the burden of the collection of information on respondents, including through the use of automated collection techniques or other forms of information technology – Development of well-designed, analyzed and tested applications which lead to better outcomes is discussed within Section 2.2.3.1. More alternative approaches to the Census which would positively impact the collected information are described in Section 2.4.

2 The Mobile Frontier

The mobile landscape is rapidly growing and is expected to continue this growth pattern for the next several years. Mobile device availability has become a necessary internal and external tool component for most organizations. 2010 marked the first year that mobile data actually exceeded voice traffic.[2] As Figure 1 shows, the volume and rate of growth in connected devices has been increasing each year, with projections of 10 billion mobile Internet-connected devices expected to be in use by 2020.[3]

Figure 1: Growth in Internet Connected Devices
Source: *Source: Wells Fargo Securities, January 23, 2012 "Fostering the People: The Shift to Engagement Apps"*



Telephones and mobile devices are converging into a single connected device that is increasingly multi-functional moving beyond just voice and messaging to web browsing, native applications, and location-based services. Mobile devices offer consumers and businesses a smaller, faster, and cheaper device, and enable organizations to engage the public. Mobile devices have also been used to transform organizations and employees, providing quicker decision making engines and allowing users to act quickly in their moments of need. As the public currently expects mobile access for all of their communication needs, government workers will soon be expected to use tablets, smart phones, and other mobile devices for their work.[4]

[2] *Wireless Industry News, August 26, 2010*
[3] *2011 Economist*
[4] *Industry Innovation: US Federal Government, Forrester Research 2011*

The trajectory of mobile application use will continue and the public and government workers will expect mobile applications to be used in the 2020 Census. The challenge is in determining the most effective uses for mobile devices to reduce the overall cost of the Census without compromising the quality and security of the data.

2.1 Mobile Opportunities in the Public Sector

Currently, the Government has engaged with constituents through public-facing mobile applications, with high rates of satisfaction, but has provided less support for mobile devices within the internal workforce. However, increasingly government organizations with distributed field operations recognize that a combination of mobile devices and mobile-enabled websites can bring significant value to their work force and the population they serve. In the areas of emergency response, FEMA recognized that mobile "...devices have increasingly become a lifeline for providing information to survivors and emergency personnel after a disaster," according to Director Fugate. "For example, after the earthquake in Haiti, the relief effort was supported by the country's mobile phone network, which quickly recovered after the disaster." FEMA has developed and launched a user-friendly mobile Web site to provide information updates, to coordinate assistance and link to Public and Private information sources.[5] In the area of law enforcement, the Department of Homeland Security announced in April plans to replace tactical radios with mobile devices. DHS cited the capability to stream real-time information, specifically video, to field agents and the ability to enable biometric identity checks at the nation's borders as some of the key drivers behind the mobile strategy.[6] Mobile applications are allowing government organizations to collect data from their distributed workforce in real-time, identify situations that threaten the safety, productivity or mission of their workforce. This technology can also help the Census Bureau to quickly identify, respond, monitor and

[5] Richard W. Walker, Federal Computer Week, May 17, 2010
[6] Alice Lipowicz, Federal Computer Week, April 18, 2012

resolve the field situations which threaten the safety of field personnel and the effectiveness of their data collection efforts.

Innovations

Did you know …

- In 2010, over ¼ of the global population - **2 billion people** - were on the Internet
- Over **5 billion** mobile devices are being used globally
- There are expected to be **77 billion mobile apps downloads in 2014**

Source: Cisco, Hyperconnectivity and the Approaching Zettabyte Era, June 2010; Eric Schmidt, Economy Conference, August 2010

With the increase of collaborative platforms for internal and external data through initiatives like data.gov, there are models being exercised in the government where data collected through mobile platforms are shared externally, and vice versa. These can have great benefits for not only the public, but for the government agencies as well. For example, IRS2Go allowed the public to download a mobile IRS application, which tracked their refunds and informed them of IRS news updates through Twitter feeds, which increased public satisfaction. The mobile application reduced the cost burden on the public and the IRS, with fewer calls coming into the call center regarding inquiries on tax and refund statuses resulting in lower overall costs.

The increased use of mobile technologies will also greatly aid the field efforts of address verification, mapping, and enumeration. Though the 2010 Census did leverage GPS-enabled handheld devices, new technology advancements and robust mapping software can provide greater efficiency and quality in field efforts. With GPS-enabled mobile devices, field workers can easily identify locations leveraging mapping software making them more efficient. With the greater resolution and screen size that tablet devices provide, workers can more easily view and edit information on the device. The same device can also work as the survey instrument for data collection efforts.

There is also a movement in many enterprises where the employee is encouraged to bring their own device thereby reducing the enterprise's first cost as well as allowing the employee to use a single device for personal or enterprise functions. Management software exists that will separate and protect the corporate data and functions to allow for a complete, secure, virtual device.

2.2 Mobile Devices/Applications for Field Data Collection

The Census Bureau plans to test the use of mobile computing devices and applications in field data collection tasks. Mobile applications can be developed to provide workforce management that can be integrated with the GPS capabilities of the mobile devices to improve the effectiveness and control of the remote workforce. Well-designed, analyzed and tested mobile applications for the enumeration functions will improve the field data collection capabilities and could lead to improved data quality at the source of the information.

2.2.1 Address Listing and Mapping

The Census Bureau intends that the scope of these tests will evaluate and prepare for the use of mobile computing devices and applications for address lists, work assignments, productivity measurements, GPS coordinate recording, downloading and updating data, and geographic information. Multiple GIS solutions exist that can be leveraged to provide improved address and mapping capabilities integrated with workload management.

IBM agrees with the Bureau's approach to initiate programs to work with partners to receive addresses continuously resulting in more accurate, timely, and available information.

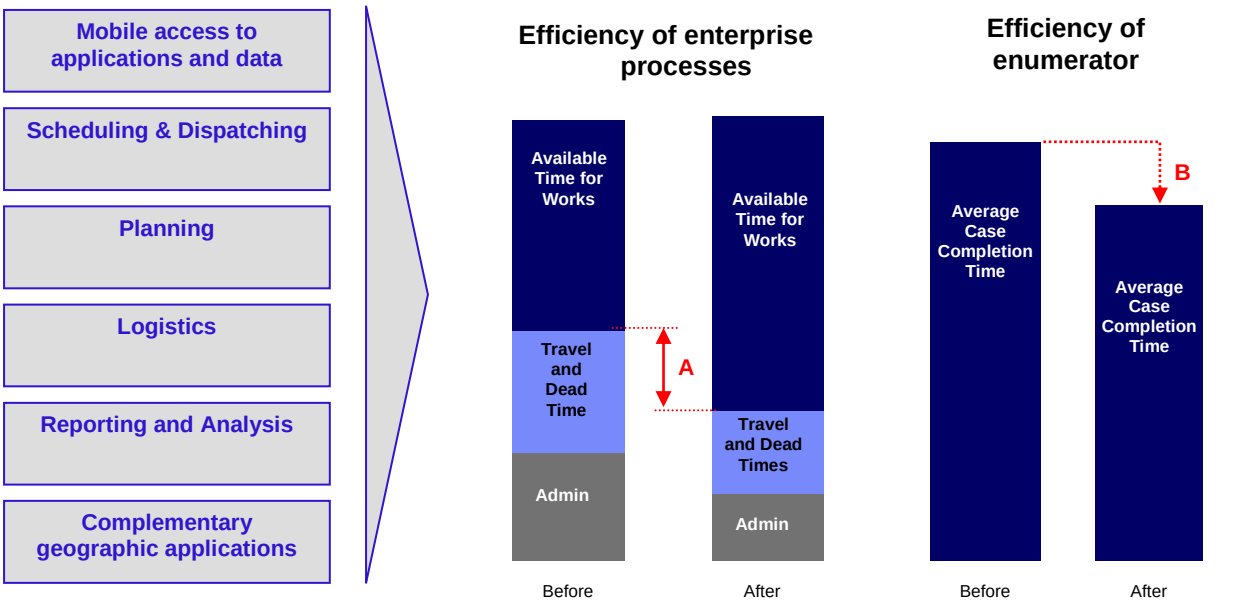
2.2.2 Workforce Management

Mobile devices are becoming integral in managing large, mobile internal organizations. Optimizing the large mobile deployment of field workers is key to improving the efficiency of these mobile employees. The way to most efficiently manage these field workers is by using a mobile workforce management (MWF) tool. MWF solutions already exist that leverage mobile technology to increase productivity and customer satisfaction, as well as to decrease operational expenses. Field operations are optimized through a process-oriented set of functionality focused on:

- Mobile access to applications and data
- Scheduling & Dispatching
- Planning
- Logistics
- Reporting and Analysis
- Complementary geographic applications.

IBM recommends that the Census Bureaus implement a mobile workforce management solution to enable the right person, at the right place, at the right time, with the right tools, skills, supporting information, and material to perform the job. An MWF solution uses the value components of:

- Work and Asset Management Integration
- Customer Service Integration - Appointment Booking
- GIS Integration - Location & Asset Look-up, Red Lining
- Scheduling & Route Optimization
- Access to Documents
- Enterprise Mobility
- Convergence of Disparate Processes / Systems



Successful implementation and usage of a mobile workforce management solution will provide a plethora of benefits to the Census Bureau during the 2020 Census, including:

- Improving quality of service to citizen
- Improving field workers productivity
- Decreasing cost of data collection
- Improving data quality and timeliness

2.2.2.1 Ability to resolve unknowns in the field via the mobile application

It is assumed that initial address information for address canvassers and NRFU enumerators will be loaded on the field workers mobile device or queue each day for data collection, verification and /or correction of the Census information. As field workers identify errors or inconsistencies in this data, they would have the ability to gather additional information on their mobile applications from a variety of sources (including observation) to resolve the problem. Depending upon the nature of the problem, it may be possible to use advanced statistical methods to match and link entities across a range of possibilities from various information

sources to create an accurate view of the information. The information could be updated on the device and flagged for possible QC review. Technology will continue to support continuous workflow operations that must include disconnected editing and remote wireless operations. While it is expected that mobile computing will be significantly more advanced, pervasive, and reliable than today, a disconnected architecture solution will still be needed. Even in a disconnected mode, the mobile application can improve user productivity in settings where wireless connectivity is not as consistent by allowing the field worker to enter data directly into the device and not on paper.

2.2.2.2 Analytics to improve quality of the addresses

Accurate and accessible address information is of high value for the government. Address information is used repeatedly across many business processes. Address Data Management should be a Bureau-wide activity that enhances the effectiveness of other survey operations not just the Decennial Census.

Address data management should include the following characteristics:

• Decoupling Address information from individual applications
• Creating a central application independent resource for Address Data Management
• Ensuring consistent address information across transactional and analytical systems
• Simplifying ongoing integration tasks and new application development
• Addressing key issues such as data quality and consistency proactively rather than “after the fact” using analytics

In cases where address or feature information is not observable or verifiable, the address record can be flagged so that a household or other knowledgeable respondent may be contacted to collect this information.

2.2.2.3 Route optimization for field workers

Route optimization relies on the underlying Master Address File (MAF) as the source for generating the route. Field workers will need to have the appropriate route information, using geographic information obtained from other data sources along with Address Analytics. The ability for enumerators to re-route themselves when obstacles are encountered will be needed. Some routing tools are able to take into account the number of apartments in a building versus suburban neighborhoods with hundreds of homes and different modes of transportation i.e. walking versus driving. Movement analytics-based services can be provided for tactical/operational and strategic planning based on traffic patterns and density maps. This approach gathers data on initial visits and optimizes plans for the next visit, if needed, and for areas which were not initially covered. This will allow the field workers to become more efficient.

As previously described, a Mobile Workforce Management solution can help facilitate efficient workforce management and streamline the process, to reduce costs. Further, analytics can be applied in the planning process to optimize workforce management. For example, statistical approaches or optimization techniques can be used to determine groups of locations that should be clustered together for field enumeration. Analytics can identify the optimal set of "tight" clusters, to minimize non-productive transportation time for the data collectors. These analytics, combined with estimates or averages of enumeration productivity metrics, can be used to predict the appropriate number of enumerators and their optimal geographic distribution. Beyond planning, optimization techniques can be used in the actual execution of the Non-Response Follow Up data collection, to optimize the actual routes of the enumerators and reduce costs. Analytics could also be leveraged to evaluate averages and metrics of enumerator productivity considering the different times required for data collection in different types of locales (e.g., dense urban, suburban, and rural areas), and identify cases where actual data collection activity falls outside the expected range.

2.2.3 Enumeration Application Functions

The enumeration functions research will focus on using various applications and mobile computing devices to enumerate households and persons. There are many highly effective application tools that could benefit the Census Bureau as new mobile applications are developed. While mobile devices may change in the years leading up to the Decennial, the applications can be developed to be device independent and to provide the best user experience possible through iterative testing.

2.2.3.1 Improving the User Experience

Optimizing the user experience with mobile applications and websites is critical for the successful implementation and adoption of the mobile channel. Focusing on the user experience allows organizations to remove obstacles that cause users to become frustrated and abandon intended self help, forms-based data collection, and workflow processes that the mobile channel was intended to achieve. Iterative design, development, test and monitoring methods, processes and tools can enable the Census Bureau to see and experience the mobile application from the workers/respondent's point of view and remove the obstacles to effective and efficient use of the mobile channel.

IBM recommends that the Census Bureaus employ customer experience management software, methods and tools that enable the multiple field tests to be measured and monitors the mobile customer experience to provide useful analysis of the user behaviour. This approach requires the ability to capture and replay customer interactions on mobile devices to analyze customer experiences to rapidly spot and address trends and issues. These tools and methods will allow the Census Bureau to measure the level of user productivity and process failure, the level of effort and frustration the user experiences in completing an interaction or transaction and provide the ability to determine why user adoption and / or transaction productivity has not been optimized in the mobile

implementation. With the Bureau's strategy 'to mount many, small tests throughout the decade',[7] this type of tool can provide significant value to improve the user experience during the Decennial census by providing iterative improvements in the mobile applications.

The key benefits of this user focused approach in both development and operations are that the approach:

- Allows the Census Bureau to maximize its mobile investment by providing meaningful metrics to drive decisions on what features to add, fix or remove from its mobile platform.
- Reduces the time-to-production / market for the service functions selected by the Census Bureau in the mobile strategy.
- Increases and optimizes the target functionality articulated in the mobile strategy.
- Provides an early warning system to detect mobile user struggles with a mobile application and provides proactive awareness into mobile application failures, usability issues or other obstacles that lead to failed transactions, abandonment and negative feedback.
- Provides data that can be used to improve the fidelity and predictability of the productivity and data accuracy of the mobile channel.

2.2.3.2 Application Development and Ease of Use

Ease of use of the enumeration application will be critical for improving the efficiency of the 2020 Census data gathering. When developing the enumeration application both the respondents and employees (enumerators and contact center agents) must be considered. In order to ensure user adoption and use of the system, the system must be designed to be customer friendly by following key design principles.

- **Focus on Simplicity—**Ease of use is a key factor for respondents to be willing to use the system and for enumerators to collect the

[7] Robert Groves, **CENSUS: LEARNING LESSONS FROM 2010, PLANNING FOR 2020, April 6, 2011, page 9**

data as efficiently as possible in order to canvas larger areas in shorter time periods.

- **Follow Best Practices for Layout and Navigation**—Best practices exist for application layout and navigation that will allow for the design and development of a system that is seamless and fluid for respondents and enumerators to use.
- **Provide Clear and Readable Content & Help—**If the respondents and enumerators are unable to understand the questions that are being asked in the application the data collected could be either incomplete or incorrect, negating the purpose of the data collection. The application design should focus on ensuring the questions are straight forward and easy to understand, as well as to provide context sensitive help that will guide the users through any potential difficult points. In addition to providing the initial help content, a feedback loop for this content can be created to ensure the help text is having the desired effect. A respondent/enumerator can provide feedback as to whether the help question was valuable for resolving their confusion and if it was not, the operations will be able to collect this feedback update the help text on a nearly real time basis to provide more pertinent help to the application users
- **Improve Quality of Input Data—**The quality of data is imperative to the accuracy of Census information and reporting, so it is important to prevent collection of inaccurate or erroneous data where possible. Data errors could be the result of misinformation provided by respondents, accidental mis-entering of data by the field collectors, or other sources. These types of data inaccuracies could be addressed through the application design to prevent capturing data that is known to be erroneous, and alert the field collector to data that is thought to be erroneous (for example if it falls outside an expected acceptable range). Each response has specific allowable characteristics, which may be as simple as text vs. numeric, or may involve further sophistication such as identified expected ranges of viable data or a list of acceptable

responses. Those "rules" can be embedded into the data collection application, to improve data quality through alerts and business rules that prevent known inaccuracies before they even get entered into the mobile device.

- **Make the Application Scalable and Flexible—**There will be ebbs and flows of data collection. Respondents will be using the application to provide data at times when it is convenient for them. As population groups tend to be on similar timing cycles, early evening and morning will see spikes of users, it will be critical to design the application servers and infrastructure to be able to handle these spikes. If the respondents are trying to use the application but are constantly waiting for pages to load they will not continue which could negate the point of the enumeration application.
- **Increase the Safety of Enumerators and Security of Data**— Analytical approaches can be used to identify expected times of enumerator collection activities along their routes. This information can be used to raise alerts in situations where a response has not been received from a data collector within the expected intervals. Further, GPS technologies embedded within the mobile devices can be used to track progress along the routes, thus providing additional confidence in personnel safety as well as security of the data in the mobile devices.
- **Multi-channel support** - The solution will support various channels to gather the census information. IBM will try to leverage client's existing investments. IBM will also bring innovative technologies to optimize or improve the existing infrastructure e.g. voice menu navigation has long been recognized as a frustrating user experience because of the nature of voice presentation. IBM's advanced call center technologies enables a user to scan and select from a visual menu at the user's own pace, typically much faster than waiting for the voice menus to be spoken. Natural Language Processing is becoming critical. IBM can provide surveys that use powerful natural language processing

(NLP) technologies specifically designed for survey text. It leads the way in unlocking open-ended responses for better insight and statistical analysis.

2.2.3.3 Experience learned on DRIS designing the Application Interface

IBM's experience on the design of the Application Interfaces (CFU & TQA) for enumeration during the 2010 Census highlighted the importance of end-used feedback and an iterative approach in their development. IBM's recommendations in this area are in synch with the Bureau's planned approach for developing new applications in an incremental and modular fashion.

IBM did analysis of lessons learned after the 2008 Dress Rehearsal and the 2010 Census operations. The lessons we learned from these activities confirmed our approach to designing and testing with the end user in mind. In particular, the lessons learned from contact center agents during the 2008 Dress Rehearsal allowed modifications to be made to the application based on their feedback and the feedback they received from the general public to improve the logical flow, the usability, and the navigation of the application. These enhancements garnered feedback from the call center agents during the 2010 Census that the application was the most user-friendly interface they had encountered in a call center.

2.2.4 Quality Control Functions

The quality control function research is to test quality control functions and applications on different mobile computing devices for both address listing and enumeration. IBM recommends using analytics to focus quality control activities on areas where the likelihood is highest that there are errors. This capability can be used both during the testing phase leading up to the Decennial as well as during the Decennial to identify activities/records that require additional follow up.

2.2.4.1 Identification of Potential Problems

Analytical capabilities can be provided on the data being gathered to improve confidence in the accuracy of the data. This will include capabilities to detect spurious information.

Pioneering identity and relationship disambiguation technology exists that determines whether multiple records that appear to describe different individuals or families are actually records for a single identity. This technology is already being used by Law Enforcement and Intelligence agencies. Analytics software packages exist that allow organizations to resolve individuals, addresses, and entities in instances where there may be duplicates and or incomplete data. The software analyzes multiple sources of data, in this case, data that the Census has collected as well as other publicly available data to resolve and remove potential individuals that may be counted incorrectly (over-counts or under-counts).

Another component of the system allows "networks" of individuals to be identified and ordered. For the Census, this capability could enable the identification and categorization of families and households where the survey data is unclear or contains errors/duplicates.

2.3 Challenges of the New Mobile Environment

While the opportunities mobile strategies present are significant and have become an organizational requirement in many institutions, there remains a number of challenges that the Census Bureau needs to adequately address in order to successfully realize the benefits from leveraging a mobile platform for the Census activities associated with Address Canvassing, Enumeration, and Data Quality. Some of the major challenges/considerations include:

- Security
- Application development

- Cost reduction/avoidance
- Modal bias

2.3.1 Security

The Bureau will also need to develop a secure mobile platform in order to protect confidential information and the privacy of respondents.

Top security recommendations to secure end-user mobile device in an enterprise include:

Eight-character alphanumeric mobile device password
– Expiration every 30 days
– Device lock after 15 minutes
– Password prompt on device should pause for incremental time after each unsuccessful login to protect against brute-force login attempts

Device wipe
– Remote (by administrator) if device is lost or stolen
– After 5 invalid password attempts to protect against brute-force login attempts

Data-at-rest encryption for employees with high-value or sensitive access
– Encryption key strength of at least 128 bits (AES)
– Protection for associated encryption keys exchanged or stored in a manner not easily retrieved in readable form at rest on the file system or in transmission
– Method to reflect the encryption status of a given device based on value, application of policy or other manner

Bluetooth® configuration set so that it is not discoverable, and only connected with paired devices on all handheld devices supporting these features

– Requirement that remote access for data synchronization or to the corporate infrastructure must go through an approved remote access gateway and support the required security authentication
– Local synchronization using direct Universal Serial Bus (USB), infrared, Bluetooth, wireless local area network (WLAN), local area network (LAN) or wireless connections
– Antivirus program run on any device with access to the corporate network
– Firewall program run on the mobile device

One of the considerations that the Census Bureau will have to address will be a Bring Your Own Device (BYOD) policy. BYOD describes the recent trend of employees bringing personally-owned mobile devices to their place of work, and using those devices to access resources such as email, file servers, and databases. One of the biggest issues with managing the BYOD dilemma is to track and control access to networks. Due to the sensitivity and confidentiality of the completed forms a secure wireless protocol is required. However, security is not the only issue that comes with BYOD. Additionally, troubleshooting could be a major problem in an environment where users are bringing a multitude of different technologies. Additionally, it is important to consider damage liability issues if an employee brings their personal device to work, and it is physically damaged through no fault of their own.

Device Security - The security of device will be very critical since the device will contain confidential information about individuals. Features are available to detect the devices with Wi-Fi signals and then various steps can be taken to secure the data e.g. wiping the data once Wi-Fi signals are detected from the device.

Remote employee authentication from the field before they can collect citizen data is vital to the security of the system. In addition uploading the completed forms and accessing government servers for other administrative purposes would require a strong authentication method.

Technologies can provide such authentication based on multi-factor biometric capabilities of mobile devices such as facial recognition and/or fingerprints. This technology can prevent unauthorized access of Census information in the event of device theft attacks (snatch and run).

In addition to security, the Census Bureau needs to be aware of "authentication". Authentication is more than just "do you have the password?" but really speaks to "is the person with the password who they ought to be so I know that the data is coming from the source I wanted?". IBM has a number of research projects underway on authentication for mobile devices which we can discuss in more detail with the Bureau.

2.3.2 Application Development

The application development lifecycle is more complicated in a mobile environment. In addition to being faster and more iterative, the Bureau has to deal with multiple device platforms and development styles. This needs to securely integrate into back-end enterprise services and cloud solutions in order to scale. The mobile environment also presents unique requirements in areas such as user interface, where there could be significant restrictions in terms of screen size.

2.3.3 Cost Reduction/Avoidance

One of the stated overarching goals for the planning of the 2020 Census is to reduce the cost per housing unit of the Census so that it costs less than the approximately $100 per housing unit that was spent on the 2010 Census. Intuitively it appears that the use of mobile applications and devices would reduce costs by improving response rates with multimode choices for an increasingly-computer savvy population and through improved workforce management and real-time data entry which would reduce input errors. These potential cost savings can be verified during the small tests which will be conducting leading up to the Decennial.

2.3.4 Modal Bias

Historically the Census Bureau has been concerned about modal bias and its effect on data quality. This is an important consideration during the development of the mobile applications to make sure that any design for mobile users does not affect the way questions are interpreted or how answers are entered. Maintaining consistency and removing bias across channels will be paramount to ensuring data quality but should not outweigh the benefits for data quality that a well-designed application can provide.

There is a lot of discussion in the federal statistics community about the potential for bias introduced through multi-modal survey instruments. IBM recommends that the Census Bureau intentionally seed some of the "many small tests throughout the decade"[8] with experiments to test for this kind of bias.

2.4 Other Thoughts

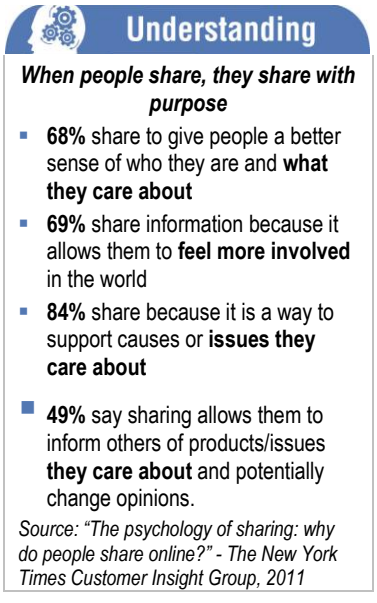
IBM is in agreement with many other organizations and individuals who believe that the 2020 Census can leverage technology and existing information to reduce costs while maintaining accuracy. While not specifically the objective of this response, IBM believes that increasing response rates through multimode contact and reducing the burden on respondents by using existing information could transform the 2020 Census.

Increasing Response Rates – Customer-facing applications will allow for a large amount of data collection via self-service, lowering the cost of the 2020 Census data while still collecting the desired data. Providing digital methods for respondents to complete their surveys including the Internet and mobile applications could provide the least expensive mode to gather survey data. In order to encourage a high response rate, these methods must be fast and easy-to-use for a diverse population. In addition to wanting their choice of channel, respondents want to use the

[8] Robert Groves, **CENSUS: LEARNING LESSONS FROM 2010, PLANNING FOR 2020, April 6, 2011, page 14**

application as their schedule allows. Knowing this it will be beneficial to allow respondents to partially complete their path through the application and then come back to the application and continue where they left off. If respondents are able to use their choice of method and on their time schedule, they will complete the data collection on their own and allow the Census Bureau to decrease the number of employees needed to do the enumeration, both in the field and in the contact centers, allowing for significant cost savings.

During the 2010 Census, the Bureau understood the power of leveraging social media channels for marketing efforts and for external communication with respondents. During the 2020 Census, the Bureau could leverage the power of social tools to not only communicate with respondents but to create a social engagement with respondents. Today, the Decennial Census is thought of as a mandatory survey. With the tools of social media, the Decennial Census can be perceived as what it truly is, a joint effort, by people and the government. The key to social interactions is involvement, engagement, and two-way communications.



Consider a new "Social Census." While accessing the Census survey on their mobile device, respondents have an option to "Be a Part of the Census and Learn More" This links to a mobile application that offers the following:

- Link through Facebook – users can see which of their friends have completed their survey and share their own "I've completed my Census" Pin.
- Community Responses – through their GPS location, the application can automatically show the response rates in their own town/city, encouraging their own participation and creating a sense of a community goal.
- Fact Finder – by using the GPS location on their mobile device, the Bureau can show the Census 2010 Quick Facts relative to the

community of the respondent highlighting how their responses are being used for meaningful statistics.

Existing Information - IBM believes that analyzing the plethora of information that is available on individuals in structured and un-structured formats can provide a very accurate view of a large percentage of the population. By gathering information from a variety of sources, the accuracy of the data can be improved. Testing could be done to validate the accuracy of the data collected in this manner. Information on individuals and family units currently exists in many government administrative records. In addition information exists in un-structured forms as well i.e. Facebook, LinkedIn, etc.

Government as an enterprise collects data from multiple, disparate sources and shares data both vertically within an organization and horizontally across agencies and jurisdictional boundaries. The Census Bureau should be looking for unique and innovative ways to collaborate – to be able to take advantage of the data collected and stored across data silos internal and external to the agency.

IBM understands that government organizations that share information need to ensure that sensitive information is protected and that only those persons with the right authority are allowed to view the sensitive information. At the same time, information stakeholders need to maintain ownership of their shared data assets and to continue governing their data without compromising data quality.

Data services currently exist that can deliver single, trusted versions of identities, entities, and their relationships by analyzing disparate and fragmented data to create actionable information. Using statistically advanced methods to match and link entities across a range of possibilities and to identify relationships among entities (people, objects, locations and events), accurate views of information can be created. A key benefit of this service for information sharing is that the source systems do not change and do not need to be completely copied or moved to another location. Data no longer has to be manually pieced

together from stove-piped systems for system requirements providing automatic access to rich data with context from numerous sources. Enriching entities this way ensures that applications or persons that are using this information to make decisions are operating from trustworthy and reliable information.

Using existing information either during the initial data collection process and/or during the enumeration process could save money by reducing labor-intensive and costly field operations.

3 Conclusion

IBM feels that the challenges that the Census faced during the Decennial Census in 2010 can be overcome. Through improved address listing and mapping, workforce management, enumeration application functions and quality control functions, the 2020 Census can be a more efficient and less costly account of the population of the United States. IBM has the ability to mitigate the risks associated with making changes to the overall design of the Census. Increased security, efficient application development, and the ability for cost reduction compared to the previous Census are the challenges that the Census faces and which must be overcome in developing a mobile device/application field test for the upcoming 2020 Census.

By utilizing technology, specifically data mining and analytics, IBM believes that the data gathering aspect of the Census could be automated resulting in potential long-term cost savings and improvements in the timeliness of the data without resulting in higher costs. By incorporating various, diverse sources of data (in structured or un-structured formats), even historically underrepresented segments of the population could be accounted for. While this design alternative represents a profound change to the Census process, in the time period leading up to the 2020 Census, a series of iterative tests could be conducted to validate this theory and quantify the cost savings. By analyzing the accuracy and completeness of various data sources - independently and in conjunction

with multiple sources - the viability of such an approach could be studied.