Computer-Assisted Personal Interviewing as a Census Data Processing Solution in Africa: Observed Opportunities and Challenges

Erik Vickstrom, Ph.D.
International Programs
U.S. Census Bureau

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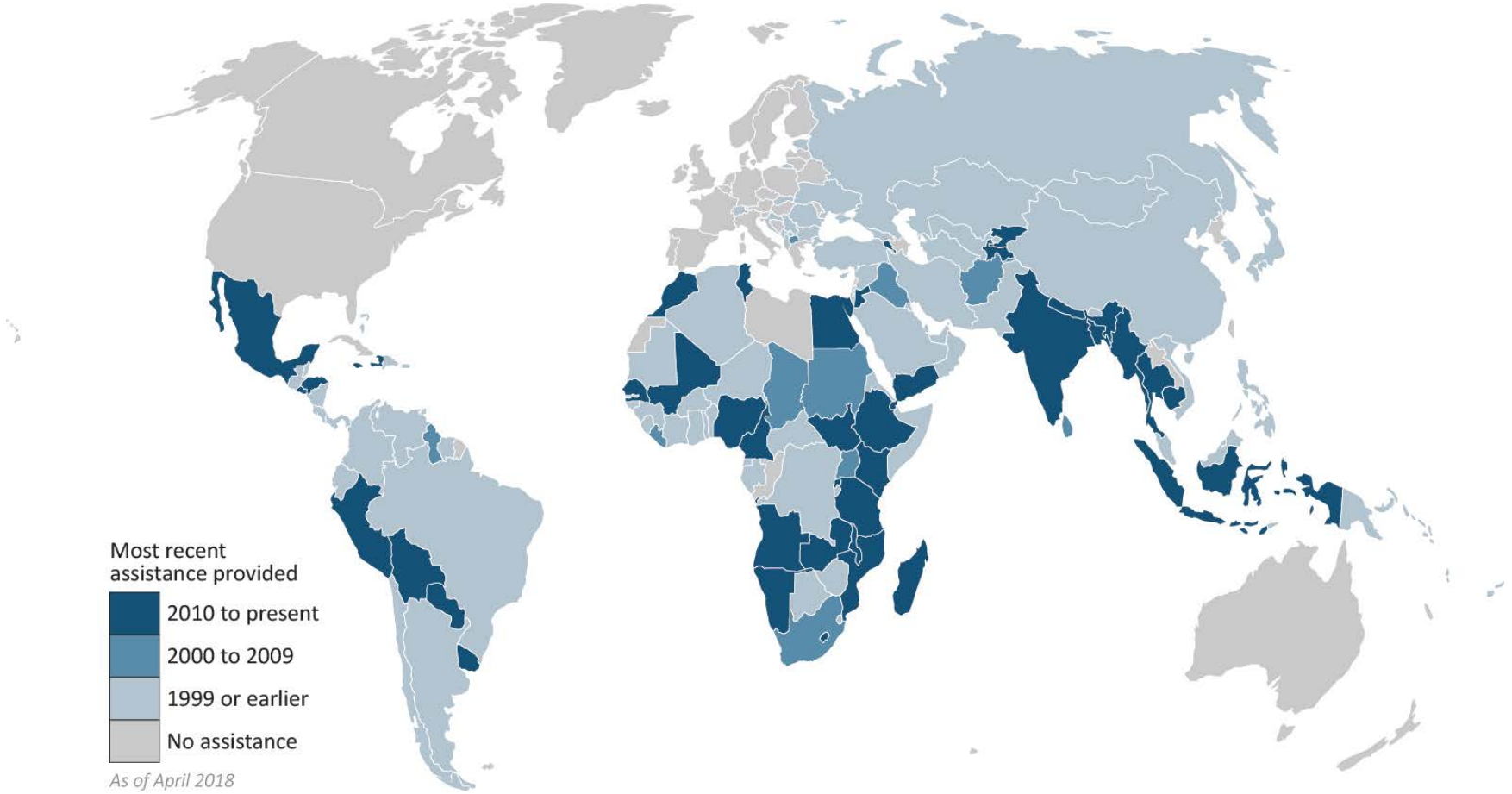
Presentation Overview

- U.S. Census Bureau's International Programs
- PAPI vs CAPI
- Challenges to implementing a successful CAPI census and potential solutions
  - Shifting timelines
  - Cost of mobile devices
  - National infrastructure
  - NSO infrastructure
  - Data security
  - Technical skills and capacity building

U.S. Census Bureau's International Programs

- Promotes international development and capacity strengthening through:
  - **Training and technical assistance** to National Statistical Offices in all aspects of census and survey taking
  - **Demographic and economic research** to encourage informed decision making
  - **Software and methodological tools development** to facilitate the census and survey-taking process for counterpart agencies and the global statistical community

Where We Have Worked



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Census and Survey Processing System

What does CSPro do?

- Data entry, including CAPI (Android and Windows)
- Data editing and imputation
- Data tabulation
- Data dissemination
- Data manipulation utilities

CSPro Experience

- Censuses
  - Over 40 countries committed to using CSPro Android for 2020 round
  - Over 300 million people counted for 2020 round by end of 2019
- Surveys
  - Demographic, labor force, income and expenditure surveys
  - Solution of choice for DHS and MICS

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PAPI vs CAPI

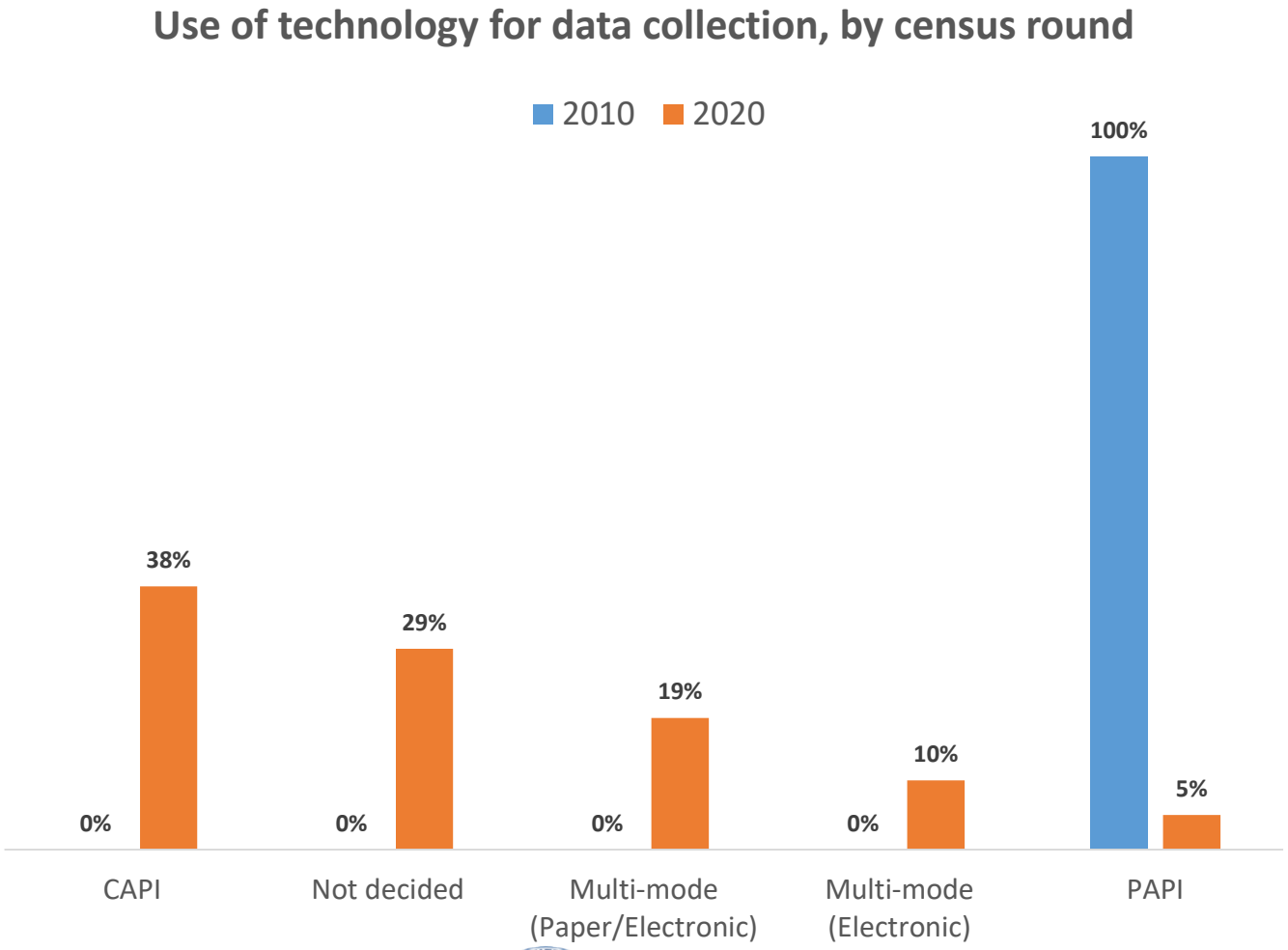
Paper-and-Pencil Personal Interviewing (PAPI)

- Interviewer-administered paper questionnaire
- Following the enumeration period, paper questionnaires are sent to a data processing facility where coding and capture operations occur
- Following data capture, data cleaning operations are performed

Computer-Assisted Personal Interviewing (CAPI)

- Interviewer-administered questionnaire loaded onto a handheld device (tablet, smartphone, laptop)
- Coding and the majority of cleaning operations implemented as part of data capture application prior to enumeration
- Data collection and capture are simultaneous
- Following the interview, the data are sent to a central computing network electronically via the internet for other means of data transfer

Trend towards CAPI use in Africa for 2020



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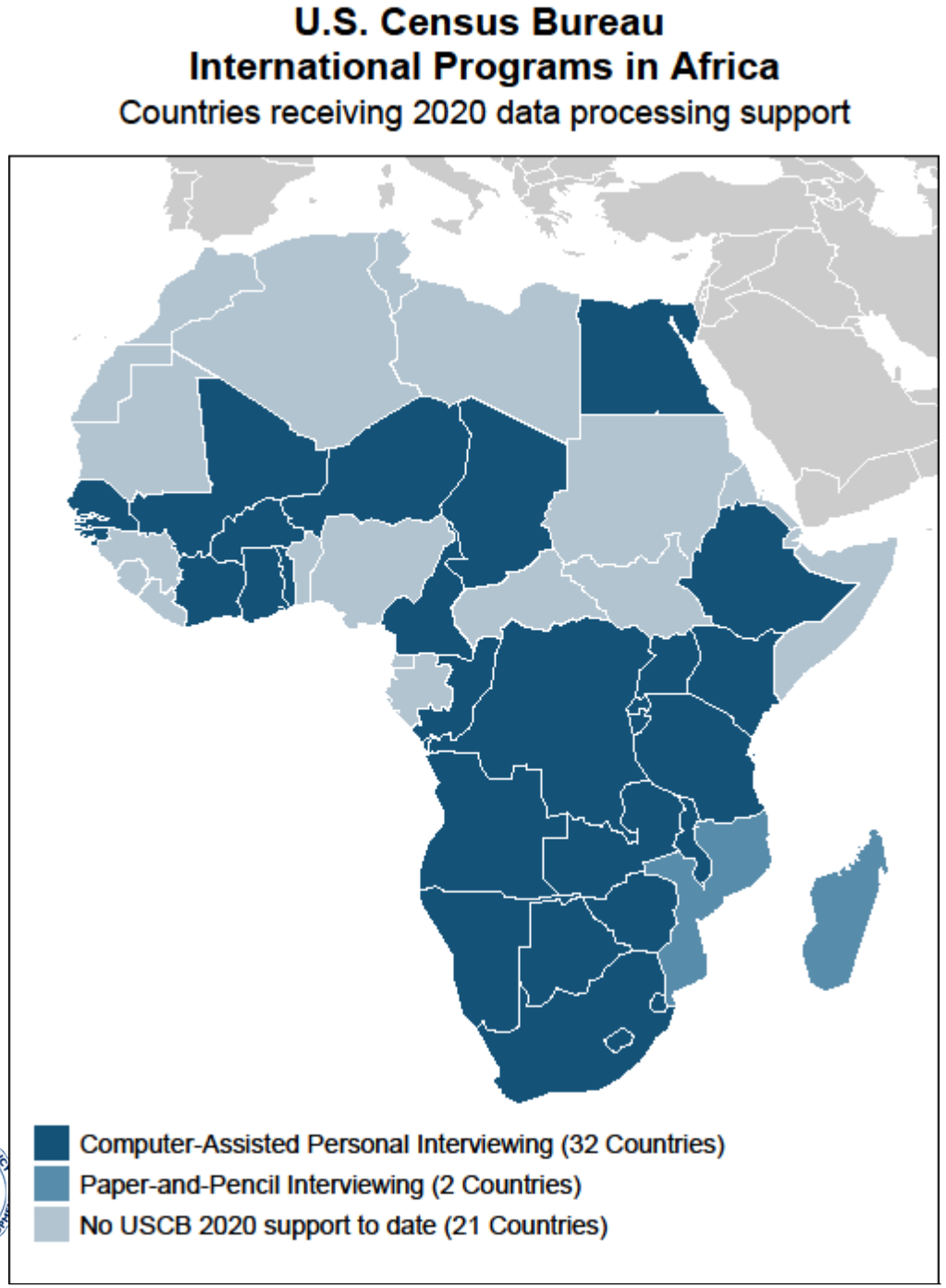
2020 Census Data Collection Technology in Africa

- Of the 34 African NSOs we have provided technical support to, 32 are committed to implementing CAPI censuses
- The majority of these countries will implement a mixed-mode approach, with CAPI as the primary data collection method and PAPI as a back-up method
- The adoption of CAPI as a data processing solution for the 2020 census in Africa is being implemented faster than anticipated



Observed Challenges and Potential Solutions

Challenge 1: Shifting Timelines

Challenge

CAPI adoption shifts a large share of the workload earlier in the census life cycle

Potential Solutions

- Avoid having CAPI census be the first CAPI experience
- Make decision to adopt CAPI early in the planning phase
- Involve IT and data processing staff early in the planning phase
- Have subject-matter specialists work closely with IT staff
- Take full advantage of pilot census, including operations, data analysis, and data quality

Challenge 2: Cost of Mobile Devices

Challenge

A census employs a large number of field staff and purchasing a mobile device for each is costly

Potential Solutions

- Tablet sharing between regional NSOs
- Partnering with other Government Ministries
- Purchase smartphones instead of tablets
- Other innovative solutions (tablet buy-back, rent devices, BYOD)

Challenge 3: National Infrastructure

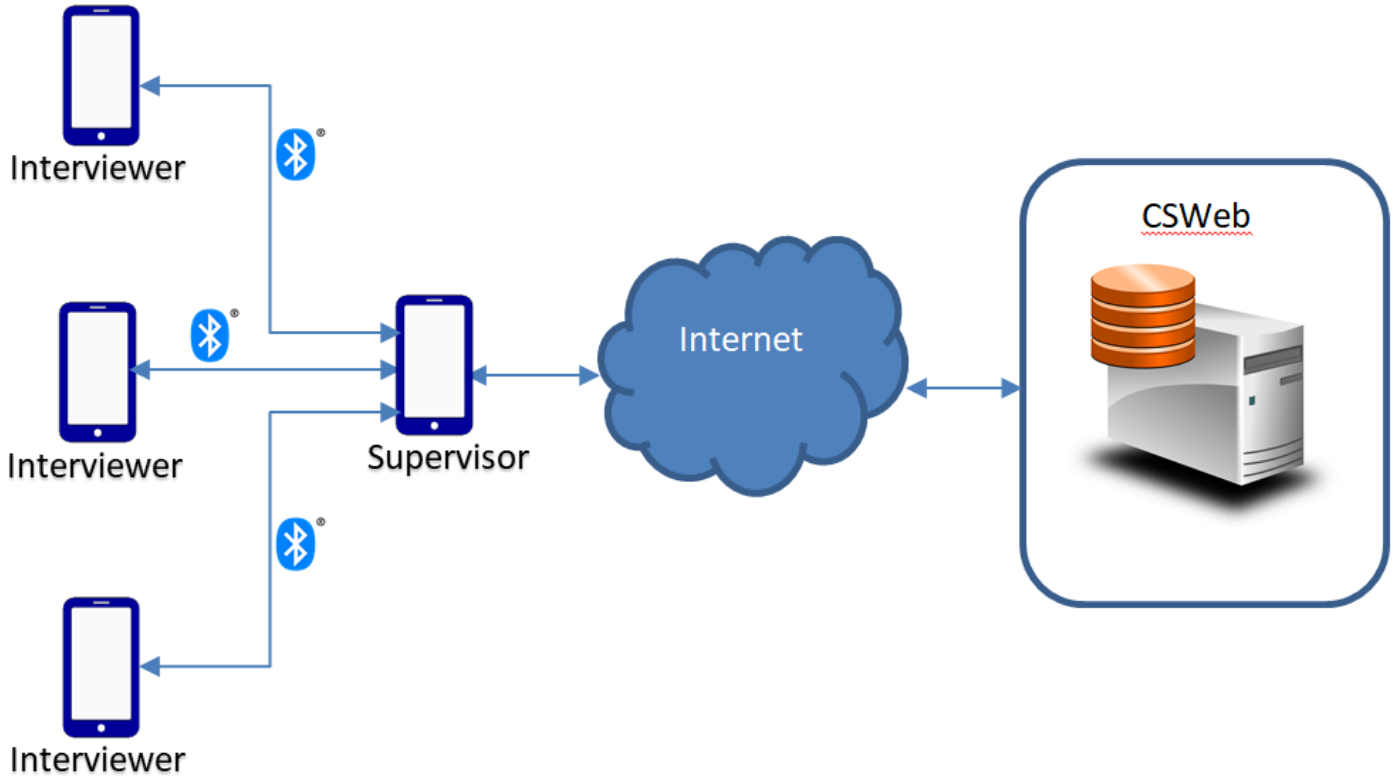
Challenge

Infrastructure issues such as availability of electricity and Internet can affect the success of a CAPI census

Potential Solutions

- Coordinate with power company providers to estimate coverage and assess the need for alternative solutions
- Collaborate with telecommunications companies to estimate cellular network coverage

Challenge 3: National Infrastructure (cont.)



Synchronization between interviewers, supervisor and central server over the internet

Challenge 4: NSO Infrastructure

Challenge

Many African NSOs are unable to conduct CAPI censuses with existing infrastructure

Potential Solutions

- Study tour to neighboring NSOs who have completed a CAPI census to identify infrastructure needs and solutions
- Outfitting dedicated NSO space to house server
- Rent server space from outside organization

Challenge 5: Data Security

Challenge

The security of electronic data can be compromised on mobile device (loss/theft) or during transmission

Potential Solutions

- Back-up data from mobile device to supervisor device and central server
- Transfer data securely via secure Internet, LAN, P2P
- Provide enumerator training on device security
- Use mobile device management to control access to device and data

Challenge 6: Technical Skills and Capacity Development

Challenge

The technical skills necessary for implementing a CAPI census are significantly different from those needed for PAPI censuses

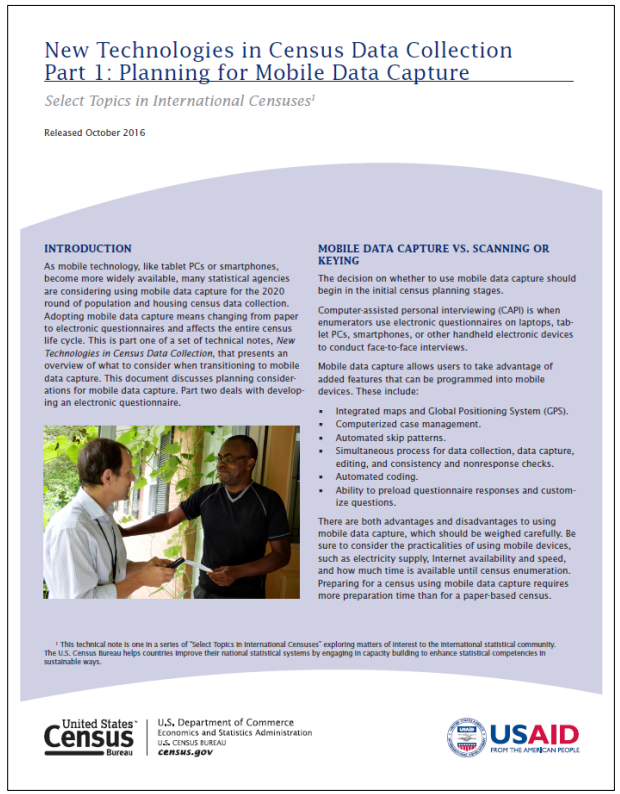
Potential Solutions

- Avoid having CAPI census be the first CAPI experience
- Secure capacity strengthening oriented training from organizations experienced with CAPI censuses
- Outsource some activities

Conclusion

- CAPI has quickly become the preferred data processing solution for African censuses
- The technology holds great potential for providing high-quality data to decision makers in a fraction of time experienced just a decade ago
- However, there are a number of challenges associated with the adoption of this new technology that African NSOs may not have experience with
- Study visits to neighboring NSOs that have recently conducted successful CAPI censuses is recommended to learn about context specific challenges and innovative solutions to overcome them

Planning Resources for CAPI Censuses



New Technologies in Census Data Collection
Part 1: Planning for Mobile Data Capture

Select Topics in International Censuses[1]

Released October 2016

INTRODUCTION

As mobile technology, like tablet PCs or smartphones, become more widely available, many statistical agencies are considering using mobile data capture for the 2020 round of population and housing census data collection. Adopting mobile data capture means changing from paper to electronic questionnaires and affects the entire census life cycle. This is part one of a set of technical notes, *New Technologies in Census Data Collection*, that presents an overview of what to consider when transitioning to mobile data capture. This document discusses planning considerations for mobile data capture. Part two deals with developing an electronic questionnaire.

MOBILE DATA CAPTURE VS. SCANNING OR KEYING

The decision on whether to use mobile data capture should begin in the initial census planning stages.

Computer-assisted personal interviewing (CAPI) is when enumerators use electronic questionnaires on laptops, tablet PCs, smartphones, or other handheld electronic devices to conduct face-to-face interviews.

Mobile data capture allows users to take advantage of added features that can be programmed into mobile devices. These include:

- Integrated maps and Global Positioning System (GPS).
- Computerized case management.
- Automated skip patterns.
- Simultaneous process for data collection, data capture, editing, and consistency and nonresponse checks.
- Automated coding.
- Ability to preload questionnaire responses and customize questions.

There are both advantages and disadvantages to using mobile data capture, which should be weighed carefully. Be sure to consider the practicalities of using mobile devices, such as electricity supply, Internet availability and speed, and how much time is available until census enumeration. Preparing for a census using mobile data capture requires more preparation time than for a paper-based census.

[1] This technical note is one in a series of "Select Topics in International Censuses" exploring matters of interest to the international statistical community. The U.S. Census Bureau helps countries improve their national statistical systems by engaging in capacity building to enhance statistical competencies in sustainable ways.

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New Technologies in Census Data Collection
Part 2: Developing an Electronic Questionnaire

Select Topics in International Censuses[1]

Released October 2016

INTRODUCTION

Converting a paper questionnaire to an electronic format involves more than simply replicating the paper questionnaire on a screen of a mobile device, such as a tablet PC, smartphone, or a laptop. The device used affects the way that enumerators interact with the questionnaire. Some questions may need to be changed to make it easier for the enumerators to work quickly and accurately on the mobile device. Further, added features like data validation, edits, and preloaded answers can be included in an electronic questionnaire. Specifications for these features must be written when developing the questionnaire, in order to program them into the software application. This document offers guidance on what to consider when adapting the questions in a paper questionnaire to work in an electronic questionnaire. This is the second in a series of briefs that presents an overview of what to consider when using new technologies in census data collection.

ADAPTING A PAPER QUESTIONNAIRE TO ELECTRONIC FORMAT

When converting a paper questionnaire to an electronic one, the questionnaire should be adjusted for the different ways in which the interviewer interacts with the mobile device. For example, a tablet PC or smartphone screen is often much smaller than the paper used to print a paper questionnaire. The screen will not be able to fit the same number of questions from a page of a paper questionnaire without compromising usability.

In addition, questionnaire designers should consider how to take advantage of the added features of an electronic questionnaire. These include the ability to preload existing data; implement consistency checks, range checks, and edits; take GPS coordinates; and offer on-screen help features.

Below are some considerations to keep in mind when adapting a paper questionnaire to an electronic one.

Roster (Grid/Matrix) vs. Verbatim Questions

A roster is a grid with the "questions" indicated only by brief terms in the column headings. A roster is often used in paper questionnaires to record tabular data and to save space on the paper. Verbatim questions are those that enumerators read as written on the questionnaire. In an electronic questionnaire, rosters may need to be converted to verbatim questions since the screen on a mobile device is often too small for enumerators to view the roster comfortably. Using verbatim questions with customized prefills may improve usability and accuracy of the responses. For instance, in a roster, enumerators must navigate a grid, making sure that the responses are recorded in the correct row. The verbatim questions allow for specific questions about each person on the roster. For example, for a question like "How old is [name]?" the [name] can be prefilled with the name of the relevant household member from the roster, one person at a time. Box 1 shows an example of the difference between roster and verbatim questions.

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New Technologies in Census Data Collection
Part 3: Timeline Impacts

Select Topics in International Censuses[1]

Released February 2019

INTRODUCTION

Building a census timeline is a foundational activity for census planning and management. This brief is part three of a series of technical notes, *New Technologies in Census Data Collection*. The two previously published STICs in this series contain more information on the logistical and methodological implications of the transition to electronic collection technologies. This STIC will assist National Statistical Offices (NSOs) in planning an e-census timeline by comparing the scheduling requirements for a traditional paper and pencil (PAPI) census with electronic collection using computer-assisted personal interviewing (CAPI) on mobile devices or computer-assisted self-interview (CASI) on the Internet. An integrated system that combines case allocation and operational control with data transmission and storage is assumed to underpin an e-census.

Principles and Recommendations for Population and Housing Censuses (United Nations, 2015) notes the importance of fully developed timelines for a range of census operations. It also suggests that the milestones associated with timelines be used to monitor progress, provide a benchmark for risk analysis, and raise alerts when necessary. The *Handbook on the Management of Population and Housing Censuses* (United Nations, 2016) expands on these recommendations by (1) providing information on the Gantt chart, the primary tool for showing project timelines, (2) listing activities that comprise census timelines, and (3) offering guidance on how to use these tools for project control and risk management. These resources should be the first stop for any NSO management team requiring background on census timeline creation.

Difference in countries' sizes and populations make it difficult to provide milestone recommendations that are definitive and generally applicable. This STIC includes some recommended milestones and offers a roadmap for how to merge the requirements of a traditional census timeline with the system development requirements of an e-census. Appendix I provides an example of milestones for a hypothetical country deploying an e-census for the first time.

TIMELINE DEVELOPMENT

Team Formation and Determining Milestones

Development of an integrated data collection system is a key difference between e- and PAPI-censuses. The NSO will oversee the development of a major new system that includes software and hardware components. Some of the first steps are creating the specifications for this system and assembling a timeline. Putting together teams with the expertise to produce the timeline and other planning documents is one of the first steps toward an e-census.

Teams comprised of software developers and IT specialists/network administrators along with specialists from field, subject matter, and geography/cartography areas, must be assembled and tasked with developing timelines for their pieces of the census timeline. Managers should provide information on the major methodological and logistical differences between e- and PAPI-censuses. Refer to the previous *New Technologies in Census Data Collection* STICs for more information on methodological differences and logistical requirements.

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https://www.census.gov/programs-surveys/international-programs/events/training/select-topics-in-international-censuses.html

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Thank You

erik.r.vickstrom@census.gov

Drivers for adoption of electronic data collection technologies in censuses

- Demand for timely data
- Demand for quality data
- Demand for improving efficiency
- Demand for cost reduction and effectiveness
- Demand for minimizing respondent burden
- Availability of cheaper and better technology
- Ability for central backstopping team to monitor enumerator work
- Stakeholder and user expectations
- National and global commitments to modernize statistical systems