United Nations Regional Workshop on the Use of Electronic Data Collection Technologies in Population and Housing Censuses

29-31 January 2018
Cairo

Session 3

Data collection with handheld electronic devices

United Nations Statistics Division
Data collection with handheld electronic devices

- Advantages and challenges
- Planning considerations
- Considerations for selecting handheld devices
- Data collection application
- Data transfer
- Security for data collection with handheld devices
- Use of geospatial technology during enumeration
- Field operation management and monitoring
- Testing the data collection application and systems
- Re-use/disposition of devices
Advantages

- Validation checks
- Automated routing
- Automated coding
- Customization of questions
- Reduced data entry errors
- Reduced time and costs
- Easier handling (vs paper)
- Added features
- Improved field management
- Positive perception
Challenges

- High cost of equipment
- More time needed for preparation
- Sufficient technical expertise
- Physical security
- Confidentiality
- Infrastructure constraints
Planning considerations

- Critical factors in planning
  - Census timetable
  - Budget
  - Questionnaire development
  - Infrastructure considerations
  - Systems and software design
  - Data transfer
  - Monitoring
  - Data security
  - Technical skills and capacity development
Considerations for selecting handheld devices

- Overview of devices
  - Tablet computers
  - Laptop (Notebook) computers
  - Smartphones
  - PDAs
Considerations for selecting handheld devices

- **Important features**
  - Processor performance
  - Operating system
  - Storage capacity
  - Keyboard
  - Screen
  - Battery
  - Connectivity options
  - Portability
  - Ruggedness
  - Sensors and peripherals
Considerations for selecting handheld devices

- **Evaluating requirements for selection**
  - Security criteria
  - Manageability criteria
  - Productivity criteria
  - Performance criteria

- **Acquiring the device**
  - Outright purchase
  - Sharing/pooling among agencies/countries
  - Renting
  - Bring your own device (BYOD)
Data collection application

- Essential features of CAPI
  - Interface for field users
  - Questionnaire navigation
  - Automatic routing (skipping)
  - Precoding
  - Customising of questions
  - Data quality control (validation)
  - Case management
  - Data management
  - Support and documentation
  - Development environment/tools for design
  - Other features: collection of operational information
Data collection application

- Development/acquisition of a CAPI system
  - In-house
  - Outsourcing
  - Configuring existing software
  - Off-the-shelf solution
Data collection application

- Evaluation requirements
  - Evaluation areas
    - Performance in the field
    - Tools for managing cases and data
    - Resources
      - Support and documentation
      - Hardware and software needs
      - Pricing and upgrades
    - Tools for design
Data collection application

- Questionnaire design
  - Adapting a paper questionnaire
  - Data validation
  - Questionnaire layout and design
  - Questionnaire specifications
  - Testing
Data transfer

Means of transmission

- Networking
  - Cellular 2G/3G/4G
  - WiFi
  - Bluetooth
- Synchronization options
  - Online
  - Off-line
- Servers
  - Web-based
  - FTP
  - Cloud-based service
Data transfer

- Technical considerations for data transfer
  - Estimating volume of data flow (for cellular)
  - Challenges of managing mobile devices over cellular networks
    - Network performance constraints (network coverage and reliability, network imposed latency, available network bandwidth)
    - Network overhead (impacted by: choice of communication protocol + how network handles disconnections and duplicated requests + whether encryption is applied to data in transit)
    - Application performance (how application handles connection and response delays)
  - Risk mitigation in data transmission
Security of data collected with handheld devices

- **Major security threats and vulnerabilities**
  - Data stored in the device
    - Physical, disclosure, application/web-based, poor authorization/authentication, use of location services, insecure storage, Bluetooth attack
  - Data in transit
    - Insufficient transport layer protection, network exploits, wifi sniffing, phishing attacks, man-in-the-middle-attacks
  - Aggregated data on the server
    - Insecure data storage, server side controls
  - Other security-related challenges
    - Enumerators fabricating data, low budgets, not fully developed infrastructure, authentication not possible where no cellular coverage
Security of data collected with handheld devices

- Measures to secure data
  - Authentication
  - Encryption of stored data
  - Device use policy
  - Use of MDM (mobile device management) technologies
  - Development of security policies
Use of geospatial technology

- Workforce management
- Support enumerator’s work in the field
- Monitoring and operational management
- Updating and correction of EA maps
Field operation management and monitoring

- **Organization of field enumeration**
  - Hierarchical structure: central, regional, local
  - Roles and responsibilities of field staff
    - Regional managers, Supervisors, Enumerators
    - Technology coordinator and team
      - Installation of system on device
      - Checking all accessories
      - Assisting in case of hardware/software problems
      - Ensuring that devices are synchronized
      - Additional training of supervisors and enumerators, as needed
  - Recruitment and training (content and technical)
  - Technical support to field staff: IT support team, Call Centre, support in case of emergency
Field operation management and monitoring

- Management and monitoring system
  - Field management tools
    - HQ and regional manager tools
    - Supervisor’s module
    - Enumerator’s module
  - Management information system for operation control
    - Performance indicators
    - Supervision alerts
    - Geo-tracking tool
Field operation management and monitoring

- **Device use policy**
  - Protection and proper handling of the devices
  - Ensuring return of the devices in good condition
  - Securing data confidentiality
  - Preventing unauthorized use of the devices
  - Confining device use to specific work areas
  - Preventing enumerators from entering fabricated data
  - Measures for non-compliance
Testing the data collection application and systems

- **Types of tests**
  - Functionality testing
  - Usability testing
  - Scenario-based testing
  - Compatibility/integration testing
  - Acceptability testing
  - Infrastructure stress testing
  - Security testing
  - Protocol testing
Testing the data collection application and systems

- Testing
  - Pre-field tests
  - Field tests
  - Modifications
  - Pilot Census
    - Enumeration process
    - Data collection
    - GIS
    - MIS
    - Training of field staff
    - Administrative procedures, including for payment of field staff
Re-use/disposition of devices

- **Benefits of re-use**
  - Optimizing scarce financial resources
  - Reducing environmental footprint
  - Reducing the initial cost of acquisition

- **Challenges of re-use**
  - Degradation
  - Battery life
  - Warranty life
  - Removal of data
  - Wiping software
  - Restoring disabled features
  - Compatibility with IT infrastructure for re-use
Re-use/disposition of devices

- Disposition
  - Necessary for obsolete or damaged devices
  - Scrubbing of sensitive data
  - Data purging
  - Early decision necessary
  - Compliance with IT security/environmental requirements