Testing Mobile Data Collection: Outcome and Lessons from Ethiopia Pilot Study

Regional conference on the use of mobile technology in statistical processes

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Outline

- Overview
- Objective
- Design and Methodology
- Data collection process
- Key Results
- Lessons Learnt
- Conclusions and Way Forward
Overview

Mobile Data Collection:

- use of mobile phones, tablets or PDAs for collecting data
- has platforms that allow customizing surveys to collect newly emerging data types:
  - Geographic data: location, paths and boundaries;
  - Multimedia: photos, audio, recordings, videos etc.
  - Electronic sensors: finger prints, scanners, health sensors, smart cards and readers.
  - Text data

Prior studies confirm merits and some associated challenges:

- Real-time access to data
- Real time data availability
- Capture geographic locations at a time of enumeration
- Integrate non-text data with text data in real time
- Real time data check for data quality controlling (logical patterns, skip features, validation checks)
- simplifies monitoring quality and progresses of projects
- Environmentally friendly as printing survey tools are significantly reduced or avoided

Multiple Language Support

- Devices can be used for future survey with no or minor cost (maintenance and replacement)
- Devices convenience to deploy to remote areas (portable small size)
- Reduce logistics deployment and management
- However, may incur initial, one-time cost of devices and additional set up costs
- Data security, data sharing, access and privacy matters require precaution

Prior studies confirm merits and some associated challenges:
Some African countries
- Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Cote d'Ivoire, Ethiopia, Gabon, Kenya, Morocco, Nigeria, Benin, Sierra Leone, Uganda, South Sudan, Senegal, Somalia, South Africa, Tanzania, Togo, Zambia, etc.

have been applying mobile devices:
- mobile phones, PDAs, CAPI and other digital devices

To collect

However, several associated challenges such as
- network shortcomings,
- software and hardware skill and training,
- collecting sensitive information as a matter of privacy, especially of patients, etc.

were reported in some of the experiences reviewed
Objective

Main objective:
∑ strengthen capacity of Ethiopia to collect data through mobile technologies by building capacities of CSA, government departments and ESA as RTI to make statistical data availability and accessible in support of evidence-based decision making for effective policy

Specific objectives:
† identify right mobile devices and compatible software
† develop procedures for receiving, collating and analyzing data
† develop mechanisms for ensuring data security and quality
† test data transmission and review field challenges and lessons
† configure and test server
† collate, merge and export data using statistical software
† keep database of the exported data at server
Design and Methodology

Existing questionnaire
§ Retail Prices (RP) and
§ Producer Price (PP, the farmer’s own products)

Study areas: Tigray Region
§ 8 market places in the region (RP)
§ 2 enumeration areas (PP)

Tools and Application:
§ Mobile device: Sumsung Tab3,
§ GARMIN GPS: to record GPS units and accuracy from the Garmin to the tablet
§ CSEntry: to develop forms
§ SIM Cards: for internet connection to synchronize data and update forms
√ Data transmission requires subscription to mobile internet or data plans

§ Server was configured at CSA
§ IT specialists and programmers follow progress of data transmission, collating and aggregating

Data Security
§ data were collected and stored in electronic device
§ mobile application was password protected, and
§ data collected on devices was saved in raw string format
√ in case of data was not encrypted, it could not be interpreted without access to the form
§ Data on the server was password protected
### Design ...

**Mobile Device Management**

- main component of mobile data collection system
- field staff skill and ability to manage mobile devices and applications installed in the devices matter the effectiveness of data collection, data security and device security.
- developed manuals/ guidelines
- delivered training on main features of mobile devices and its application related to the intended purpose

**Eg. Data Transmission tools**

<table>
<thead>
<tr>
<th>Functions</th>
<th>Description/ Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mobile Data</strong></td>
<td>Tap icon to activate or deactivate mobile data.</td>
</tr>
<tr>
<td><strong>Wi-Fi</strong></td>
<td>Use Wi-Fi if cellular data is not available and when wireless internet connection is available.</td>
</tr>
<tr>
<td>Note: disable automatic login to a wireless network to save or when the battery runs low.</td>
<td></td>
</tr>
<tr>
<td><strong>GPS</strong></td>
<td>Activate the GPS feature to enable geo-tagging. GPS feature is generally poor indoors; in such cases, capture location outside buildings and rooms.</td>
</tr>
<tr>
<td><strong>Screen rotation</strong></td>
<td>It helps to choose the orientation/view of the template on the device. Based on the length and width of the form, one can rotate the screen in portrait or landscape mode for convenience during counting.</td>
</tr>
<tr>
<td><strong>Power saving and Blocking mode</strong></td>
<td>Charge when battery status falls below 20 percent to preserve power.</td>
</tr>
<tr>
<td></td>
<td>Blocking notifications from apps except CSEntry also saves battery life</td>
</tr>
</tbody>
</table>

### Quick Actions and Notification Tools

**Functions**

- Turning device on and off
- Locking, unlocking the device and Data Security
- Switching to silent mode
- Battery
- SD card
- Widgets
CSEntry:

- is compatible software for MDC

Benefits include:

- free software, no cost, except for expertise/programmers’ fee
- Data entry applications run seamlessly on both Windows and Android devices without modifications – a "build once, deploy many" system
- Easy to manage data entry
- Multiple language support: local languages to display questions on the device screen
- Easy to create complex questionnaire formats
- Partial and end-level save, and view saved data

- Enabled with manageable logical rules, robust error and consistency checking (skip, repeated questions, protect, pre-filled and pre-calculated values)
- Enables to update/edit a questionnaire remotely during survey without affecting previously collected data
- Case tree for simplified navigation
- Rosters for blocks of repeating questions
- Support data types: GPS location data, numeric, text, multiple responses, date, time, location, etc
- Automatically synchronize questionnaires and data using Bluetooth, Dropbox or FTP
- Export data to Excel, Stata, SPSS, and other formats
- Use reference files for panel surveys
- Implement complex logic using the CSPro programming language
Data collection process

Data Collection Procedure
§ Data collection/entry form developed using final questionnaire, and using pcs
§ Includes:
  § entry fields,
  § GPS points,
  § picture,
  § manage, update/modify and
  § save data
§ The forms are imported to and kept in the CSEntry folder in the device

1. **Menu** sorts cases and filters incomplete cases
2. **Name of the survey**
3. **Displays** a screen to type a field note.
4. **Search:** to search and filter response listing
5. **Short description** of the field being entered
6. **Item type** being entered;
   § more descriptive than the field label,
   § possible to use local language
7. **Displays** check boxes/ buttons/ combo boxes/ date selectors etc.
8. **Left and right navigation buttons** to move back and forth
   Note it is different from the devise’s back button in that case it disables modifying cases.
9. **CS icon:** brings up the case tree

some elements of the form appeared on mobile devices
Brief on Data Entry steps

- **CSEntry** is installed on mobile device,
  - the **CSEntry** icon will appear on the screen
- The icon directly leads to “Entry Applications”, (survey tools/ or forms)
- Tap either of the forms, wizard that request operator’s Id pops up
“Start New Case” or icon on the right side of the screen begins a new interview/case.

“01010110107” represents combination of ID items:
01 → Region
01 → Zone
01 → Woreda
1 → City
01 → month and
07 → year

Some known values like year can be automatically filled by the program.

**Wrong answer** and an error message. For example, when a Woreda which doesn’t belong to a particular Zone is entered, the error message “The selected Woreda doesn’t belong to this particular zone, please enter again” will appear in Amharic as seen in the picture. This allows re-entering the right answer and reduces error.
Capturing Geographic Information

- Next to ID items and moving forward begins to capture GPS points
- **Open location** enables to easily search satellite for the device to identify location
- A failure to identify location warns "there was an error reading the GPS coordinates"
- A successful capture leads to the next field (Q0. Item Category) to choose the item from the list on the next page

Data collection process ...
Capturing Item Pictures

- selecting the item and tapping next button, the system camera automatically invites enumerator to take picture of the item
- If the picture is as per the required quality, select “√” button; if not, deselect or click “refresh” to take another picture

Local language

- Enumerators can change language of the form by clicking the option (three hyphens) at the top right corner of the screen → ‘Change Language’.

Field Notes

- Enumerators have the option for taking remarks/notes during the data collection activities by clicking the note symbol in the middle of the top of the screen
Saving data
1. Partial save: save data at any instant
   Entering data can be continued later starting at the point where partial save was done
2. End level: When data collection is completed
   The case will be saved with the ID items as a unique name under the case tree.

View Data
- Data viewed in grid in the case tree (the green CS icon). The case tree displays all fields/ variables entered and field label as well as the field response
- Then enumerator can move from one item category/question to another
- Grid View: Clicking a specific record from the list displays the collected data in a grid view

Modifying Data:
- re-open and modify saved cases
  - ID of the questionnaire opens/resumes
  - Taping on the case name on the case tree opens the saved data, then modify the variable
- Save the update after modification
Data Transmission and Updates

Synchronization options:
§ RP: to synchronize retail price data
§ RP Update: to download/ update (if any) the RP form from the server
§ PP2: to synchronize producer price data
§ PP2 Update: update PP2 form

Enumerators update the forms with prior notification from supervisors and coordinators.

Note:
Synchronized data can be modified any time at the field, and, its synchronization updates the previous case at the central database
Data collection process ...

Workshops
1. The project launching workshop to:
   ✷ introduce key stakeholders with the new technology,
   ✷ the options and opportunities of use of mobile devices for data collection in general.
   ✷ Research and academic institutions, media, development and other stakeholders were part of the workshop.

2. Training workshop for enumerators, supervisors, and coordinators:
   ✷ introduced objective and advantages of mobile technology, concepts and definition of terms,
   ✷ Supported by guideline on device management, CSEntry and data entry management using the forms on the devices

Pre-test
   ✷ to avoid unforeseen difficulties
   ✷ to evaluate understanding of enumerators
   ✷ to test CSEntry forms developed
   ✷ to evaluate mobile network
   ✷ to test capturing GPS coordinates
   ✷ to test transmitting data
   ✷ to test processes of collating and aggregating data on local computer

pretest has played important role in testing logistics related and overall procedure

➤ A one day post pre-test discussion
During data collection

- In most cases, synchronization was done at the end of each day
- Synchronization of data and forms were successful at every moment
- Synchronized data were easily aggregated from the server
- GPS data was captured properly
- Network was accessible in the EA and was strong to synchronize data
- 3G network was also available in some cities like Mekelle and Wukro.

Importantly: before data is synchronized, there must be a separate place/folder for each enumeration area in which data sent from a specific enumerator or enumeration area are uniquely aggregated.

- reduces complication of data management.
- requires prior programming during form design
  Eg: give unique name for each mobile device, for instance, naming the device with the name of the EA.
- Failure to do so will likely give two or more folders with the same folder names, and as a consequence, data will be over-written by the next synchronization from any of the enumerators or EA.
Key Results Achieved

The fieldwork was completed successfully affirming that the need to adopt use of mobile data collection

† Capacities of experts of CSA, ESA and participants of the project is developed throughout the survey procedures and applications:

§ develop and customize software
§ configure server to aggregate data
§ manage mobile devices,
§ transmit data and aggregate data
§ Security matters, etc.

† Awareness created among stakeholders of NSS about the project and on the use of technology for data collection

The project tested that it is possible to:

§ collect and store data using electronic device
§ easily synchronize data
§ Easily capture new data types: GPS and multimedia data
§ easily collate and aggregate data
§ Integrate text data with non-text data
§ Manage real-time supervision of enumerators, etc.
§ To finally deliver a timely accessible, relevant and quality data
Lessons Learnt

**Mobile Device**
- Samsung Tab3: has a big flat screen, is easy to handle, and suitable to read and navigate the form easily.
- Enumerators did not face significant challenge to manage, but, sunlight reflection was a challenge.
  - Adjust display options/ increase display light
  - However, it requires a sustainable solution for such inconveniences.

**CSEntry form**
- was manageable, no significant difficulty to view form, read questions.
- Data quality control mechanisms such as
  - skip patterns and control logical flow of questions
  - validation checks for answers entered
  - quick review of data quality was quite useful
- Hence, data cleaning ended by the end of the survey/ without delay

• There are experiences in using mobile devices like PDAs and CAPI systems for data collection in Ethiopia.
• However, need to use of the technology in an improved and advanced way.
• The project has taught us that mobile data collection has several options to improve statistical system in Africa.
• However, it requires early and thorough planning; well-organized training; and skilled manpower to:
  • manage mobile devices,
  • operate software applications,
  • configure servers and local data hosts,
  • manage, compile, analyze and disseminate data,
  • manage logistics and resource, etc
<table>
<thead>
<tr>
<th>Components</th>
<th>Some favored features</th>
<th>Limitations and risks</th>
<th>Strengths and opportunities</th>
<th>Minimum requirement and recommendations</th>
</tr>
</thead>
</table>
| **Hardware** | § Internet: Mobile data, Wi-Fi  
  § Mobility: Easily handled  
  § Interface and Customization: color, resolution, screen size  
  § Battery life: if fully charged, stays one day  
  § Update: allows software program update  
  § Storage/ memory: mostly adequate internal storage and capacity  
  § Add-ons and Peripheral support: external memory, and add-on devices  
  § GPS enabled | § High initial cost  
  § Battery life may depreciate by use of internet for long time, multimedia (video, music), etc.  
  § Internal memories may be filled with irrelevant files for the survey  
  § Sunlight effect: Difficulties to view forms on the device screen (mostly at mid-day – where sunlight is too much)  
  § Theft of devices | § One time cost  
  § No or little maintenance cost  
  § Color schemes, mobile data/network and Wi-Fi, screen savers and display light can be easily managed  
  § Most smartphones may have adequate internal memory and memory card slot to back up data and transferring | § Device must qualify minimum requirements like software compatibility,  
  § must be appropriately held for extended re-use  
  § Set prior mechanism to save battery, power bank (remote areas & limited electricity)  
  § Device use policy and training (device damage, data loss, use of memory and device functionalities for self-purpose, theft of devices, etc.)  
  § Devices display function shall be enhanced  
  § use of external tools like cover that protects sunlight may reduce screen display during much sunlight |
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</thead>
<tbody>
<tr>
<td>Language</td>
<td>Some support local and multiple language</td>
<td>After devices are distributed to field, if need arise for significant changes to templates that can’t not be updated remotely by the server, it may require to send programmers or to collect the devices to the main office at extra cost.</td>
<td>Multiple options: CSEntry, ODK, SurveyMonkey, iFormBuilder, etc.</td>
<td>Forms for questionnaires must be carefully developed before staff and devices are deployed.</td>
</tr>
<tr>
<td>Compatibility</td>
<td>mostly developed to flexibly compatible with mobile devices and easily managed by users</td>
<td>§ This becomes worsen when surveys are big with a number of enumerators and the EAs are far apart in different locations or regions.</td>
<td>§ Source: Some open and some non-free</td>
<td>Adequate pre-test practice and training must be done to test software compatibility, consistencies and efficiency of the designed template</td>
</tr>
<tr>
<td>Component</td>
<td>Some favored features</td>
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<tr>
<td>Transmission</td>
<td>§ Transmission model: Devices and software support synchronization via: SMS, USSD, Voice, Web, Flash drives, Bluetooth, Dropbox, FTP, SMS, General packet radio service (GPRS) § Survey tools: § Some sort of updates can be took place from the server whenever an update exists</td>
<td>§ Network, § Internet § Electric</td>
<td>§ Multiple modes of data transmission/synchronization – Alternatives for urgency and internet/Wi-Fi/ connection failure. § Every data collector used to easily update templates/questionnaires and continue working on the updated questionnaire without affecting or making any change of previously collected data.</td>
<td>§ Data only SIM card with 2G/3G network service may be appropriate than full SIM service. This enables to § flash drive and SD card, to save pictures and big files to save internal memory</td>
</tr>
<tr>
<td>Components</td>
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</tr>
<tr>
<td>Data aggregation and analysis:</td>
<td>§ Receive, § Collate and § Analyze data.</td>
<td>§ Internet connection errors and limitations may inhibit prompt or timely receive of transmitted data § Loss of SD cards/ memories, flash disks or any other external devices that hold data</td>
<td>§ Instant access to the collected data as soon as data is transmitted § Timely data: data delivered with simply merging data from each EA and as per the ways of delivery up on data request by users § Quick survey result (aggregated) dissemination and provision of timely evidence</td>
<td>§ Keep server updated and installed § Ensure access to server without interruption by electricity or any other means so as not to stack the data transmission/ synchronization process at the field § Data managers and IT specialists shall frequently visit server and transmitted data, collate those data, evaluate and disseminate feedbacks/ error/ and corrections (if any) to the enumerator at the instant where the enumerator is at the EA § Need to upgrade use of latest technology § improve methods of controlling, consistency, and completeness of data</td>
</tr>
<tr>
<td>Components</td>
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<td>Limitations and risks</td>
<td>Strengths and opportunities</td>
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<td>------------</td>
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<td>----------------------------------------</td>
</tr>
<tr>
<td>§ Enable to create:</td>
<td>§ device lost or theft, § virus attack smartphones or external memories, § accidental or deliberate deletion of data files, etc</td>
<td>§ Instant access to the collected data as soon as data is transmitted</td>
<td>§ Timely data: data delivered with simply merging data from each EA and as per the ways of delivery up on data request by users</td>
<td>§ Suggest mechanisms to ensure data quality</td>
</tr>
<tr>
<td>§ password protected interference and accesses mobile device</td>
<td>§ Data may be at risk mainly at two points: 1. During Data transfer and (due to unprotected sync, connection or internet failure, etc) 2. At Central Data Base (damage on server and/ or local computer, virus infected local computer)</td>
<td>§ Quick survey result (aggregated) dissemination and provision of timely evidence</td>
<td>§ Data security tools, protocols, encryption, and related regulatory frameworks should be identified (both at on mobile devices and central databases)</td>
<td>§ ownership, possession and utilization of data and devices need to be clearly articulated</td>
</tr>
<tr>
<td>§ restricted access for forms and questionnaires</td>
<td></td>
<td></td>
<td>§ Data security must be kept at any of expected levels or sources of data and device insecurity</td>
<td>§ Back up database</td>
</tr>
<tr>
<td>§ password protected access to server</td>
<td></td>
<td></td>
<td>§ Unauthorized disclosure policy and data confidentiality, and enhancing open data</td>
<td>§ Secure file transfer protocol</td>
</tr>
<tr>
<td>§ secured file transfer protocol</td>
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</tbody>
</table>
Conclusions and Way Forward

MDC is preferable due to its benefits:

§ on-field quality control and supervision
§ reduce errors, missing and keep data quality;
§ keep efficiency: minimizes cost and time;
§ reduce data loss,
§ access for new data types
§ local network access;
§ integrating non-text data with the text types;
§ easy deployment and minimum logistics management effort;
§ Option to use mobile devices from partners – returnable after field work in case of insufficient budget and lack of time to buy devices;
§ growing mobile and information technology
§ enhance speed, volume, and coverage of data collection;
§ meet basic principles of official statistics and data revolution principles

† Final template, device, server configuration, SIM card, and all other related materials have to be readily available right from the beginning.
† A pre-test and post pre-test evaluation is crucially important
† Standards, manuals and guidelines wrt device application, form, device and form use, data management, reporting and security must be organized
† The study and review of experiences in Africa has revealed that
§ MDC system has several options to improve statistical system in Africa
§ Africa can apply the technology – that enables African nations to
  • make informed decision, formulate timely relevant policy, and to effectively plan, manage, monitor and evaluate development engagements.
must have monitoring and evaluation on data quality, coverage, reliability and timeliness, feasibility and conformity of chosen device, desirable features of applications, available resources, connectivity and network coverage, logistic and practical challenges, remote areas in line with survey design, data security and privacy

It requires:
- early and thorough planning;
- identifying right technologies and service providers,
- estimating costs of hardware, software, processes (transmission, aggregation, management, planning timeliness, training & piloting, ensuring data quality and data security)
- well-organized training;
- skilled manpower

multi-disciplinary approach implementation, strong and active survey management and participation of team of experts from different disciplines, test feasibility of the pilot to a more complex type of survey and methodology, Continued investment on innovation and use of technology is important, Continue research and develop further concepts and methodologies based on the updating technologies and situations, Commitment of African governments and stakeholders of NSSs to make initial investments wrt:
- developing Information Technology System and integrating it with Statistical system;
- equipping NSOs with recent technological supplies, tools, systems and expertise for MDC and management (mobile devices, add-ons and peripherals);
- software development; and
- advancing existing technical skills and production of new skilled generation
Thanks for your attention
## Comparison of Paper and Mobile based surveys

<table>
<thead>
<tr>
<th>Criteria</th>
<th>PAPI</th>
<th>MDC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Questionnaires:</strong></td>
<td>- Flexible to format</td>
<td>- Follow standard formats to fit device screen</td>
</tr>
<tr>
<td>- development</td>
<td>- Incurs cost for papers, tonners…</td>
<td>- Requires use of applications &amp; software tools</td>
</tr>
<tr>
<td>- field-test</td>
<td>- Can be printed, shared, commented immediately</td>
<td>- Difficult to share forms for immediate comments</td>
</tr>
<tr>
<td>- unstructured qualitative data</td>
<td>- Can be tested with no or at low risks</td>
<td>- Testing has risks as it needs deploying mobile-devices in the field for testing</td>
</tr>
<tr>
<td></td>
<td>- Easy to write on</td>
<td>- Needs skill and exercise to type through keypad or keyboard</td>
</tr>
<tr>
<td></td>
<td>- Better writing speed</td>
<td>- Typing through makes it slow</td>
</tr>
<tr>
<td></td>
<td>- Can use local to write responses</td>
<td>- May support local language</td>
</tr>
</tbody>
</table>
Comparison of Paper and Mobile based surveys

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</thead>
<tbody>
<tr>
<td><strong>2. Survey management:</strong></td>
<td>- Printing and tracking challenges</td>
<td>- No or low printing challenges</td>
</tr>
<tr>
<td></td>
<td>- Too tedious to deploy paper-questionnaires</td>
<td>- Easy to deploy devices as it is a single device distributed to each enumerator</td>
</tr>
<tr>
<td></td>
<td>- Change/update to survey questionnaires is impossible or re-printing is costly once deployed</td>
<td>- Easy to remotely update questionnaire/forms on devices</td>
</tr>
<tr>
<td></td>
<td>- Tracking data and survey work back to the center can be a laborious, complicated process and slow process that delays timely data access</td>
<td>- Data tracked/transmitted easily in real time</td>
</tr>
<tr>
<td></td>
<td>- Possible to flexibly manage number of field staff</td>
<td>- Number of available devices determines flexibility to increase number of field staff or enumerators in case of urgency to complete field work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Needs skilled and well trained field staff</td>
</tr>
</tbody>
</table>
## Comparison of Paper and Mobile based surveys

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<thead>
<tr>
<th>Criteria</th>
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</tr>
</thead>
</table>
| 3. **Data quality:** | - Difficulty to manage, especially, for big questionnaire with big number of questions and sub sections  
                      - Limitations to keep skip patterns and control logical flow of questions  
                      - Challenges to read and understand handwritten text  
                      - Requires data entry  
                      - Highly exposed to data entry error  
                      - Requires manual exploration to check for errors and missing data  
                      - Manual/poor data quality control | - Easy to manage surveys through software apps  
                      - Easy to keep skip patterns and control logical flow of questions  
                      - Easy to manage validation checks for answers entered  
                      - Hence, data cleaning lasts during data collection/or at the field  
                      - Possible to quick review of data quality  
                      - Easy to track enumerators and survey procedures  
                      - Automatic or easy data quality control |
## Comparison of Paper and Mobile based surveys

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<th>MDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. <strong>Cost &amp; Time:</strong></td>
<td>Ongoing costs for:</td>
<td>One – time cost of mobile devices</td>
</tr>
<tr>
<td>- Ongoing costs</td>
<td>Printing</td>
<td>Ongoing (insignificant) SIM card and</td>
</tr>
<tr>
<td>- Time for data entry</td>
<td>transportation</td>
<td>internet service costs</td>
</tr>
<tr>
<td>- Provision of timely data</td>
<td>storing questionnaires</td>
<td>Free software and applications</td>
</tr>
<tr>
<td></td>
<td>Requires lots of time for data-entry operations</td>
<td>May incur maintenance and add-ons cost:</td>
</tr>
<tr>
<td></td>
<td>Double data entry and reconciliation cost and</td>
<td>- batteries</td>
</tr>
<tr>
<td></td>
<td>additional time</td>
<td>- replacement</td>
</tr>
<tr>
<td></td>
<td>Both affect provision of timely data for</td>
<td>- loss of devices</td>
</tr>
<tr>
<td></td>
<td>analyses and</td>
<td>- No time required for data entry and double</td>
</tr>
<tr>
<td></td>
<td>Affects timely evidence based planning and</td>
<td>entry</td>
</tr>
<tr>
<td></td>
<td>policy formulation</td>
<td>- Real-time access to data for analysis</td>
</tr>
<tr>
<td></td>
<td>Paper printout voided, not</td>
<td>- Has positive impact for evidence based</td>
</tr>
<tr>
<td></td>
<td>environmentally friendly</td>
<td>decision making</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- No or minimum paper printout,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>environmentally friendly</td>
</tr>
</tbody>
</table>
Comparison of Paper and Mobile based surveys

<table>
<thead>
<tr>
<th>Criteria</th>
<th>PAPI</th>
<th>MDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. <strong>Collection of new data types:</strong></td>
<td>Requires additional devices over questionnaires for collecting non-text data types</td>
<td>- Multi-functional single devices</td>
</tr>
<tr>
<td>- Location</td>
<td>GPS capturing devices</td>
<td>- GPS enabled</td>
</tr>
<tr>
<td>- Multimedia</td>
<td>Cameras</td>
<td>- Audio and video tools</td>
</tr>
<tr>
<td>- Biometry</td>
<td>Sensors</td>
<td>- Sensors and</td>
</tr>
<tr>
<td></td>
<td>Non-text data types difficult to integrate</td>
<td>- Other functionalities with add-ons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Non-text data can be integrated with text data in real time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Real-time access to location and pictures</td>
</tr>
</tbody>
</table>