

# NOMAD

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*Humanitarian Operations Mobile Acquisition of Data*

## *Mobile Data Collection Systems*

*A review of the current state of the field*

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### NOMAD Partners



ACAPS



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## **LIST OF ACRONYMS**

ACAPS: The Assessment Capacities Project

DCI: Data Collection Interface

GIS: Geographic Information System

GSM: Global System for Mobile Communications

GDP: GeoData Portals and visualization systems

IASC: Inter-Agency Standing Committee

IDE: Interactive Development Environment

IOM: International Organization for Migration

IT: Information Technology

MD: Mobile Devices

MDC: Mobile Data Collection

MDCS: Mobile Data Collection Systems

NOMAD: Humanitarian Operations Mobile Acquisition of Data

## 1 DEFINING MOBILE DATA COLLECTION

Mobile Data Collection (MDC) is the targeted gathering of structured information using devices such as smartphones, PDAs, or tablets. In the last few years, in addition to continuous improvements of earth-observation and web mapping techniques, the increasing use of new sources of geo-information based on new mobile technologies has emerged. This has created insights and opportunities into the mechanisms of sudden onset crisis related data collection, analysis and mapping.

The humanitarian community also recently discovered that mobile phones are useful tools for collecting data in the field. The arrival of devices allowing geo-localization of data collected also raised interest in the humanitarian community for new technologies such as mapping SMS incident reports or SMS based data collection. As a result, an abundance of mobile data collection applications and initiatives appeared in the last seven years in the humanitarian and early warning field.

Mobile Data Collection Systems (MDCS) ask questions that are answered on mobile devices, therefore requiring two-way communication, either immediately or with delayed synchronization of data. It is more than simply sending bulk SMS to a targeted population, and different from subscription information services that provide alerts such as the [Tsunami Early Warning System](#) and [The Australian Early Warning Network](#). Mobile data collection applications are often used internally in an organization, customized to fit with existing organizational processes. This may mean using services or applications that are outside most people's day-to-day experience with mobile use.

MDC differs from the crowd-sourced data aggregation paradigm popularized by tools such as [Ushahidi](#). Data aggregators collect unstructured data found as posts to services such as Twitter, Facebook, email, and SMS, and they mine this data for information. By contrast, mobile data collection systems run designed surveys which collect specific information from a target audience. The audience can be either organizational staff trained to conduct surveys/assessment or the target population being studied can be surveyed directly via their personal mobile devices. In either case, the specific questions and structured responses can be important to rapidly collecting information deemed essential to an emergency response.

## 2 RESEARCH OBJECTIVES

Choosing the most appropriate technology strategy for a specific organizational context and communication environment remains a difficult task for humanitarian workers, for the following reasons:

- The main challenge remains to identify the appropriate mobile data collection system to fit the multiplicity of operational contexts humanitarian organizations have to operate in.
- The second challenge is to keep track of the evolution of a very dynamic sector and the constant evolution of new technologies flourishing on the data collection market.
- Last but not least, while the rich content of information - whether available on the internet or in the data derived from mobile data collection - poses opportunities for application in crisis management, it also poses challenges derived from the analysis of the quality, accuracy, and reliability of the data.

All those challenges apply particularly in the field of early needs assessment which requires a small set of highly accurate standardized information to better inform emergency decision makers.

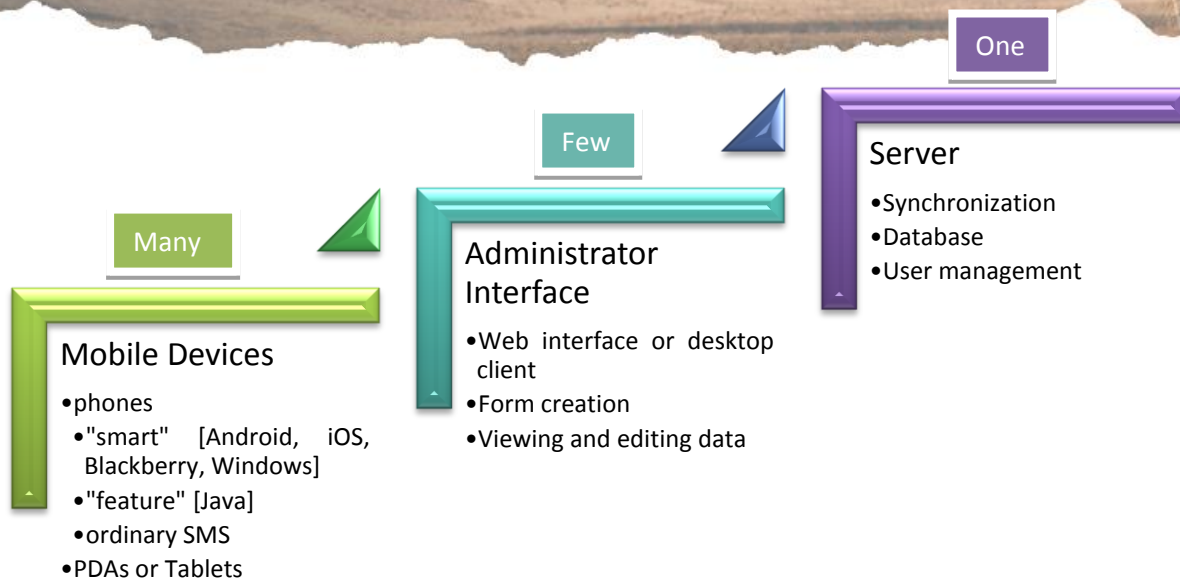
Since mobile data collection systems have been used for years in the humanitarian sector, there is enough experience and operational learning on the issue to allow a decent review of existing initiatives, their performance, and a mapping of potential use in different operational contexts. To this end, ACAPS and CartONG have partnered under the NOMAD banner to evaluate the current state of the MDC field. This report investigates the available options for the moment, categorizing and grouping for operational goals where relevant. It also suggests trends for the near future and a strategy for maintaining the freshness of this knowledge base.

The purpose of this research is to review existing mobile data collection software systems, projects, and initiatives. In order to accomplish this, NOMAD undertook the following tasks:

- Build a matrix of analysis for mobile data collection systems currently available for use in humanitarian relief interventions.
- Review the use of MDCS and successful experiences, potential, gaps and limitations, specifically for data collection speed, analysis and reporting. Selection of most promising application and tools.
- Model and build a decision tree to facilitate choice and use of MDCS according to different operational contexts.

### **3 BASIC COMPONENTS OF A MDCS**

While system architecture approaches vary greatly, there are a few **components that are common to all MDCS**:



1. **Many mobile devices** are used for data collection. Each MDCS supports a subset of mobile device technologies. The most simple hardware requirement is plain SMS (FrontlineSMS<sup>1</sup>, RapidSMS, and SoukTel AidLink specialize in SMS). More complex forms are built on Java (Nokia Data Gathering; EpiSurveyor) or a smartphone platform such as Android (ODK and its offspring; Imogene) or Windows Mobile (CSPPro; DevInfo; IMSMA<sup>NG</sup>). Some MDCS can support multiple mobile platforms for the same form and server (Acquee; Mobenzi Researcher; Pendragon Forms).
2. The **administrator interface** is used by a *few* survey designers and data analysts. It is used to design the form layout and create the mobile application. It sometimes allows for data entry and viewing of the collected data. For tools with integrated visualization features such as DevInfo and IMSMA<sup>NG</sup>, the admin interface acts as the analysis platform and generally provides basic descriptive statistic functions as well as line graphs and bar charts.
3. The third component is *one server* which hosts the database. It includes some mechanism to upload data from the mobile devices. Connectivity can be via internet, SMS, or directly copying files. Once collected, the server presents the data via the administrator client interfaces, and sometimes the mobile devices in the case of bi-directional synchronization systems (Imogene; EpiCollect). Some systems integrate the administrator interface and the server software. This is usually done when the synchronization is not done via the internet and the data is directly uploaded from the devices, such as CSPPro and CyberTracker.

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<sup>1</sup> For hyperlinks to individual MDCS pages, see the Tool Matrix link explained in [section 4.5, Reading the Spreadsheet](#).

## 4 RESEARCH METHODOLOGY

NOMAD first began collecting information on used cases of mobile data collection in October 2010, when CartONG interviewed several project teams engaged in mobile data collection in the field. These interviews informed the creation of a wider web-based survey of existing mobile data collection initiatives among humanitarian actors in November 2010. The survey asked respondents to comment on their organizational requirements and experiences. The findings from the survey, available on the [NOMAD website](#), set the initial orientation for the NOMAD project.

High level work to plan the scope and direction of the research continued at the NOMAD workshop on 22-23 June 2011 in Geneva. During the workshop, NOMAD members refined the research objectives and compiled lists of resources, building on those identified in the web survey. More detailed research commenced at the end of July and continued through the end of 2011.

The methodologies for each of these tasks are broken down in the sections that follow.

### 4.1 Selecting the Tools<sup>2</sup> to Review

A preliminary list of tools to consider for inclusion in the study was drafted at the June 2011 NOMAD workshop. The team also identified external resources with lists or reviews of MDCS. Several of these resources were published by MobileActive.org, including their [Mobile Data Collection Tools - Comparison Matrix](#) and Go-To Resource for Mobile Data Collection (version published in Sept 2010).

Investigating these resources led to other web links and sources of knowledge. Internet searches for “mobile data collection”, “mobile surveys”, “humanitarian data collection software” and similar search terms turned up a few more options. From this selection process, **36 mobile data collection systems were identified as preliminary candidates** to be further reviewed for potential inclusion in the study. See [Appendix 1](#) for the list of these tools with some brief notes.

These 36 tools were then examined more closely to narrow the list down to those MDCS that have functional mobile survey components and are ready for application in humanitarian interventions today. This filtering was again informed by the findings in the 2010 survey report mentioned above. The criteria for inclusion in the report included:

- Does the tool fit the definition of a MDCS defined in section 1?
- Is the tool currently available for download or purchase?

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<sup>2</sup> This document uses the terms “MDCS” and “tool” interchangeably.

- Is there enough information from documentation, demos, and user experiences to accurately evaluate the tool?
- Has the tool been used on humanitarian or other NGO/UN projects? Or is it being targeted for this audience?

MDCS with a mature software platform and either experience or a target audience in the humanitarian sector were chosen for more detailed analysis.

## 4.2 Determining the Review Criteria

In a similar manner to selecting the tools, a draft list of review criteria for this study was brainstormed during the June 2011 NOMAD workshop, with the 2010 Use Case survey as a starting point. Parameters were identified in six categories:

- Form features (support for features like mandatory questions, skip patterns, and multiple languages)
- Synchronization (method of sync; 1 or 2 way; local or cloud<sup>3</sup> storage; etc.)
- Interoperability and Connectivity (export formats and database details)
- Hardware requirements and capabilities supported (device, desktop, and server operating systems; device features, like GPS, photos, etc.)
- System features and platform characteristics (open or closed source; user friendliness; methods for reviewing data)
- Visualization and analysis features, for MDCS with a visualization component (import/export formats; graphs and charts; reporting features, etc.)

Beginning with these sub-lists, the parameters were iteratively refined as the preliminary review of tools revealed which features distinguished one MDCS from another. Similarly, the evolving plan for the web decision tool described in the next section identified questions that are relevant to users. Some parameters were chosen to facilitate answering these questions.

## 4.3 Planning for NOMAD's Web Decision Tool

The NOMAD team started to develop the web decision tool during meetings in Geneva in August and September 2011. Brainstorming among the group produced an ordered list of questions that could be answered by non-technical users new to mobile data collection. Each question represents one or more filter criteria that would be applied to the research results to narrow down the list of qualifying

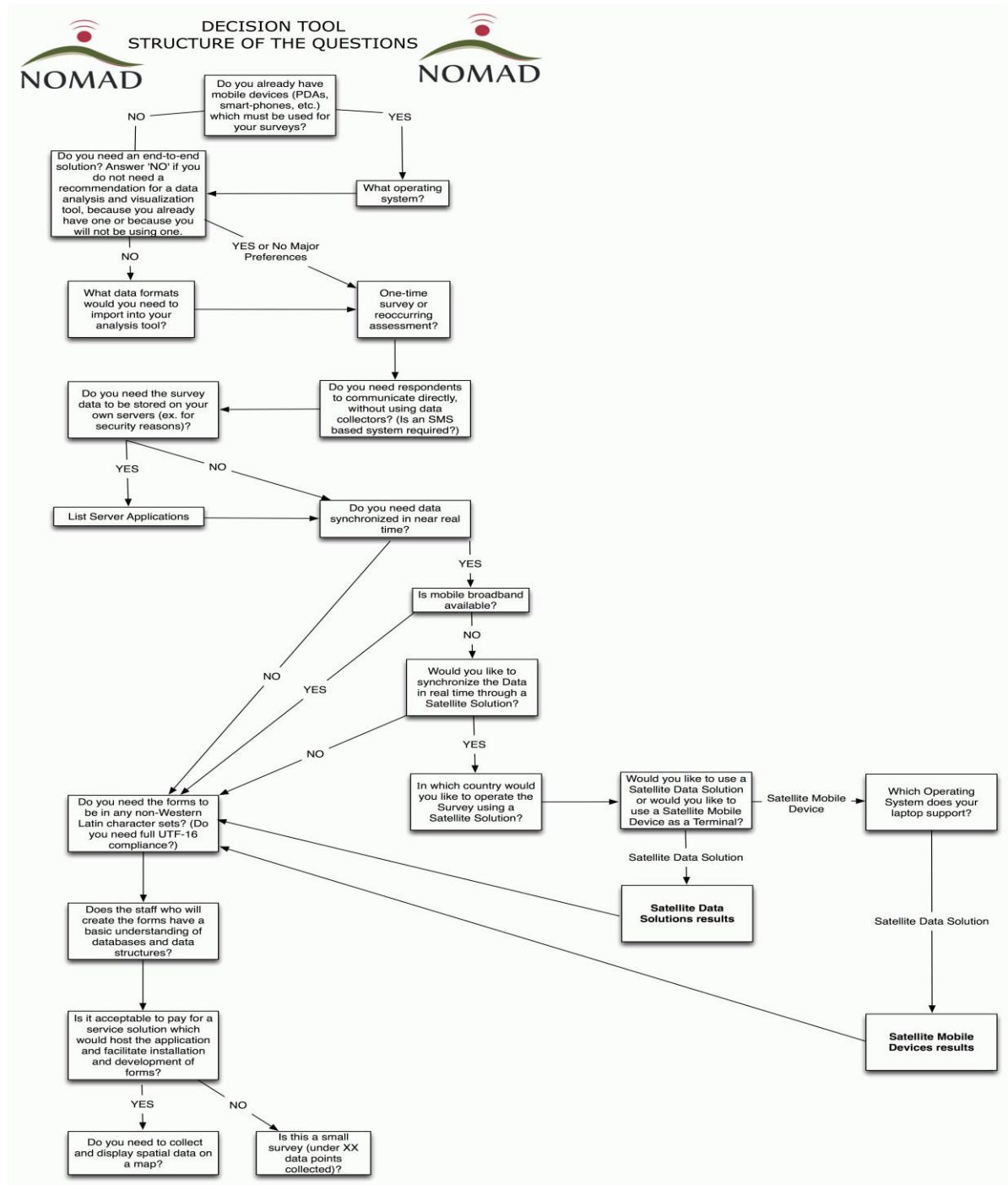
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<sup>3</sup> "Cloud" services rely on online servers and databases. All users connect to the same infrastructure, which is maintained by an outside group. [http://en.wikipedia.org/wiki/Cloud\\_computing](http://en.wikipedia.org/wiki/Cloud_computing)



tools. The question list employs conditional skip patterns, where the responses from one question determine the sequence of following questions.

The web tool development began in November, building on the structure and format of the existing NOMAD web site. The data supporting the decision tool is a database derived from the tool matrix research, described in the next section.



#### 4.4 Method for Evaluating the MDC Tools

The 24 tools identified were then examined more closely, with the review criteria and web decision tool questions in mind. For each tool, 39 questions were answered relating to criteria for: form features; synchronization; interoperability and connectivity; hardware requirements and capabilities supported; and system features and platform characteristics. Additionally, for MDCS including a data visualization component, 11 more questions were answered regarding visualization and analysis features.

To collect and ultimately present this information, a [tool matrix spreadsheet](#) of MDCS and review criteria was compiled using Google Docs. Each piece of information obtained filled the corresponding cell at the intersection of the MDCS reviewed and the question. A guide for reading the spreadsheet can be found in the next section.

The methodology for the review followed an ordered progression of steps for each tool. Data points were inputted in the tool matrix cells at each level until no empty cells remained.

1. Review the tool's webpage[s] for an overview.
2. Download and read available documentation.
3. View the code page for open-source tools.
4. Test a demo of the form creation software, if available.
5. Test a demo of the mobile application, if available.
6. Contact users with experience with the tool, if available.
7. Review web forums and user communities for the MDCS.
8. If unanswered questions remain after steps 1-6, contact the tool developers to request further documentation and/or direct answers to open questions.

This sequence was sufficient to complete the questions for almost all the tools. The exceptions were two MDCS which have not responded to information requests, and one commercial company which has been hesitant to release confidential information to non-customers. The team continues to attempt to secure detailed information from all three.

#### 4.5 Reading the Spreadsheet

This document refers extensively to the Google Spreadsheet that contains the [Tool Matrix](#), the detailed results of this research.

Using the methods detailed in the previous section, the research parameters identified by the NOMAD team were placed as the columns, grouped into six horizontal sections. The first five sections are completed for all MDCS. The sixth section at the far right is only applicable to tools with accompanying visualization systems. The parameters are listed next, in the same order as in the tool matrix.

### Form Features

- Subforms
- Dropdown lists
- Skip patterns
- Mandatory questions
- Data range & type enforcement
- Help (tool tips)
- Pre-selected responses
- Automated calculations (for data validation)
- Default values
- Field length enforcement
- Easily adapted screen layout (fonts, icons, colors)
- Form can switch between multiple languages
- Handles non-standard characters (supports UTF-16)

### Synchronization

- Can sync via SMS
- Interrupted sync resumes?
- Runs without creating/using a Sync module
- Type of sync (cloud, server type, etc.)
- Data storage local or in cloud?
- Bi-directional sync of data
- Forms can be downloaded/updated in the field
- Sync tracking manages re-synchronization

### Interoperability and connectivity

- Server / sync module export formats
- Database auto-generated? (list formats)

### Hardware requirements and features supported

- Device OSes supported
- Desktop OS required for tool
- Server/Database Platform
- GPS
- Pictures
- Video
- Audio
- Bar Codes

### System Features and Platform Characteristics

- Open Source?
- Module has access/security/rights management
- User friendly (forms can be modified easily)
- Forms can be created without coding knowledge
- Alert messages
- Can browse completed records in a structured way on the device
- Can browse completed records in a structured way from a computer
- Data can be entered from a computer

### Visualization and Analysis features

- Is the viz tool standalone or integrated
- Data formats that can be imported
- Are basic graph types supported?
- Mapping built in?
- Auto-generated reporting?
- ... with custom designed dashboards?
- Flexible queries?
- One way-table and graphs
- Cross tabulation
- Apply filter or strata:
- Formats that graphs/tables/maps can be exported to

The parameter categories are in Row 1, with the individual parameters in Row 2. Row 3 of the spreadsheet serves as a legend for the values. First, it specifies the color coding for the matrix. Each cell is colored according to the following key:

- Yellow: unanswered questions
- Pink: questions with conflicting answers, or the answer could not be found
- Blue: the answer was found through the documentation or from a secondary source
- Green: the answer was found through use testing of the MDCS

**Empty blue or green cells correspond to *negative* answers.** For example, the first cell represents Subforms for the Acquee tool. The empty green box means that directly testing the tool revealed that Acquee does not support grouped subforms. This method of representing “No” with null [empty] was chosen to facilitate visually scanning a column to find tools which support a given feature. If a cell contains a value, that tool partially or completely supports that feature.

Continuing right in Row 3, legends for individual columns explain keyed values where answers are more complicated than yes/no. Occasionally, comments on the column are expressed in Row 3 as well.

Vertically, the topmost group of tools is the pure Data Collection Interface (DCI) systems. The MDCS towards the bottom of the spreadsheet contain visualization components, either built in to the systems or as an integrated package with a reporting tool. These are labeled as GeoData Portals and visualization systems (GDP).

The tool matrix can be used in two ways. First, if a specific set of features or parameters is required, those columns can be used to identify the tools which meet the project needs. Alternatively, if two or three tools are being compared, their rows can be compared to identify differences between the tools.

## 5 RESEARCH FINDINGS

The tool matrix resulting from this research yields some insights into the spectrum of MDCS available. No two systems have the same profile, with each providing its own niche subset of features. This diversity allows for a finely discerned selection process when choosing a MDCS, which will be supported by the web decision tool.

Evaluating the 36 initial MDCS yielded 24 tools that are suitable candidates for consideration in the humanitarian context. The tools that did not make this cut fall into two categories. Some are inactive and no longer supported by developers or other users. A few well-documented tools survived this deficiency because they proved valuable on previous projects. The second reason for exclusion was a poor fit with the mobile data collection paradigm expounded in the introduction to MDC. Tools in this study support well-defined surveys, structured responses, and targeted respondents.

## 5.1 Tool Review

While many of the MDCS support collecting GPS coordinates through enabled devices, collecting more specific **GIS data is not prioritized** in this field. Of the tools studied, only IMSMA<sup>NG</sup> supports a GIS tool (ArcGIS with a paid license). Some GIS tools such as ArcGIS have mobile apps for Android and iOS that could be used in parallel on the same devices as a MDCS.

The visualization components of all of the tools reviewed were disappointing. **None of the tools integrated a comprehensive reporting tool.** Very few even supported customizing the most basic graphs or charts. DevInfo and IMSMA<sup>NG</sup> are the most developed visualization packages. For the rest, the features available can be useful for taking a first rough look at the data, but analysts will want to export the raw data to their favorite reporting ([Pentaho](#), [Jaspersoft](#)) or statistical analysis (SPSS, Excel) tool. Tools that support direct access to relational databases such as MySQL, PostgreSQL, or MS SQL Server can also be connected to standalone reporting packages.

There is far more variance in the effort required to install and configure the systems than in the difficulty of creating the forms. All of the tools surveyed provide a clear interface for creating a form and adding questions to it. Some of the more complicated form generation interfaces (Imogene, CPro) require a bit of user training, but the difficulty varies roughly proportionally to the range of features the forms support. If training is completed before the tool is needed as part of preparedness planning, each MDCS can create forms in a day or two, with the exception of the commercial tools where the company creates forms as a service.

Compared to form creation and using the administrator interface, there is a wide range in the complexity of the back-end systems, the software and hardware required for the server. Some are single-step hosted services requiring the user only to create a login account. Others necessitate installing web servers, databases, and interactive development environments (IDE). IT demands and time requirements are key indicators used in the grouping of tools in the next section.

## 5.2 Grouping the Tools

Since the tools reviewed in this study serve users with varying contextual needs, a ranking or hierarchy of tools is not appropriate. The best tool for one group is not necessarily the most appropriate for another organization, or even the same group working on a different project.

Yet it is helpful to give some structure to the findings and attempt to a classification of the tools within a few important criteria. A relief worker tasked with selecting a tool needs to know the feature set of the tool, but it is also important to assess the ease of use and target audience for each tool. This section buckets the tools relative to three important considerations for the usability of these tools.

1. Active development and user communities
2. Technical complexity and ease of setup
3. Appropriateness for rapid assessments

While the raw data in the tool matrix is as objective as possible, the combination and evaluation of that data into the analysis presented in this section is necessarily more subjective. Qualifiers like “easy” and “active” are relative terms and dependent on an organization’s capacities, requirements, and expectations. The recommendations presented in this section assume the MDCS user is familiar with mobile data collection and has basic computer skills, with limited support from their organization’s IT resources.

### **5.2.1 Active Development and User Communities**

Some of the MDCS in this study have been around for more than a decade, while others are just being released and tested. Older tools often have the advantage of being debugged and refined over version cycles and proven on many implementations, while newer tools are likely closer fits with current hardware and modern trends in surveys. In either case, an active user base and ongoing development are rough indicators of a tool’s relevance today. Hot new tools may buzz with initial activity. More established tools with an ongoing user and development base indicate that the tool has earned the loyalty of its users and/or funders.

Active user communities are more than indicators of a tool’s value to other organizations; other users can be resources to learn from. Many tools have user forums or email discussion lists where users share experiences and help to answer questions for each other. These are communication channels between users, and also can be used by tool developers to better understand the priorities of their users.

Active development and support is especially important when tools are complex and interconnected with outside pieces. For instance, a tool relying on the Apache Tomcat web service may need to be updated as users upgrade to Tomcat 7. Other users who have completed this upgrade can share their experiences with the rest of the community. Highly customizable tools offer more features, but also require more documentation and support from developers.

In the case of open-source software, the developers and the users can be the same individuals. This report takes a neutral stance on whether being open-source is a positive attribute for a tool. Open-source MDCS are described as such to indicate cost of software licensing, and also to assess if a tool remains actively in development.

	Inactive user support community	Active users supporting each other
<b>Ongoing development with active support</b>	<ul style="list-style-type: none"> <li>• doForms</li> <li>• EpiCollect</li> <li>• EpiSurveyor</li> <li>• Global Relief Technologies RDMS</li> <li>• Imogene</li> <li>• IMSMA<sup>NG</sup></li> <li>• KoBo</li> <li>• Majella Insight</li> <li>• Mobenzi Researcher</li> <li>• Nokia Data Gathering</li> <li>• Pendragon Forms</li> <li>• Souktel AidLink</li> <li>• ViewWorld</li> <li>• Voxiva Custom HealthConnect</li> </ul>	<ul style="list-style-type: none"> <li>• CSPro</li> <li>• FrontlineSMS</li> <li>• Open Data Kit (ODK)</li> <li>• openXdata</li> <li>• RapidSMS</li> </ul>
<b>No recent updates or development support</b>	<ul style="list-style-type: none"> <li>• Acquee</li> <li>• DevInfo EmergencyInfo</li> <li>• GeoChat</li> <li>• OASIS Mobile</li> </ul>	<ul style="list-style-type: none"> <li>• CyberTracker</li> </ul>

The MDCS in the survey have been arranged into quadrants indicating these two indicators. In the chart above, the left side contains tools where users are not communicating with each other. This could be because the user base is small, tool use is straightforward, or no one has set up a communication mechanism. On the right side are tools with large user bases sharing information with each other. Vertically, the bottom boxes contain tools that have not been updated recently or are no longer supported by the developers. Some are in the process of securing funding for revisions, while others have undefined plans for the future. The top are tools with current versions which match modern hardware and are supported by ongoing development, either commercial or open-source. Users should evaluate tools in the lower-left with caution.

### 5.2.2 Technical Complexity and Ease of Setup

Another informative measure for comparison of MDCS is the amount of technical expertise required. The level of effort required to install and configure the systems varies widely. Some are as easy to set up as creating an account on a web site. Others require downloading and installing a suite of interconnected software components. This section does not refer to the difficulty in creating the forms themselves, which has a much smaller variance.

Several of the tools are provided as commercial software as a service (SaaS) packages. Often for a fee, these companies handle all of the back-end technical requirements for setting up the database and synchronizing the mobile devices.

Some companies also create the forms to the custom specifications of the user. Because these services were not directly tested as part of this review, this report cannot comment on each company’s proficiency in setting up their systems for a new user. But MDCS evaluators should be aware that these options exist if they do not have the technical capacities (including time) to configure a system themselves. The two MDCS below are provided by organizations that maintain the back-end server infrastructure and create the forms with input from the users. Both systems have very little publically available technical information and were not forthcoming with details when requested by NOMAD.

- Voxiva Custom HealthConnect
- Global Relief Technologies RDMS

The remaining tools can be roughly separated as either turnkey installations requiring little configuration, or as complex systems requiring IT staff to set them up. The simpler tools can be either online hosted services or one-step installations on local hardware. Generally, the easier tools provide fewer advanced features and may not be customizable in as many ways. Rigidity can be a cost of simplicity. Some in the first set of tools require paid subscriptions. Pendragon Forms is the only commercial tool in the second set.

Turnkey installations requiring no IT expertise	Complex installations requiring IT proficiency
<ul style="list-style-type: none"> <li>• Acqee</li> <li>• CSPro</li> <li>• CyberTracker</li> <li>• DevInfo EmergencyInfo</li> <li>• doForms</li> <li>• EpiCollect</li> <li>• EpiSurveyor</li> <li>• GeoChat</li> <li>• KoBo</li> <li>• Majella Insight</li> <li>• Mobenzi Researcher</li> <li>• Souktel AidLink</li> <li>• ViewWorld</li> <li>• Voxiva Custom HealthConnect*</li> </ul>	<ul style="list-style-type: none"> <li>• FrontlineSMS</li> <li>• Imogene</li> <li>• IMSMA<sup>NG</sup></li> <li>• Nokia Data Gathering</li> <li>• OASIS Mobile*</li> <li>• Open Data Kit (ODK)</li> <li>• openXdata</li> <li>• Pendragon Forms</li> <li>• RapidSMS</li> </ul>

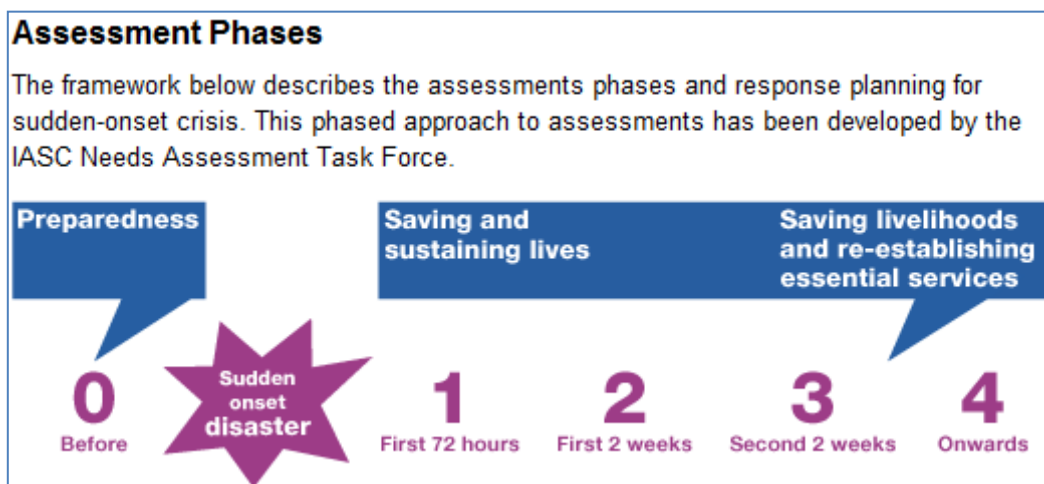
\* Preliminary finding since full information on the tool was not made available for this study.



### 5.2.3 Appropriateness for Rapid Assessments

When dealing with sudden onset disasters, the information requirements and considerations change quickly as time passes. Preparing for mobile data collection before a disaster happens can be more deliberate, with rounds of testing and feedback. However, during the first few weeks of an emergency, and without adequate preparedness measures including the selection and set up of a specific MDCS in case of disaster, organizational resources are most often extremely limited. It is unrealistic to rely on ad hoc MDCS selection during a crisis.

The IASC Needs Assessment Task Force defines four assessment phases with specific timeframes after a sudden onset disaster. The phase 0 corresponds to the preparedness phase, when specific arrangements relative to roles, responsibilities, tools and MDCS can be agreed upon between humanitarian actors:



During phase 1 (first 3 days), there is very little time to set up a MDCS from scratch if nothing was planned during phase 0. Data collection techniques include typically key informant interviews and direct observation. In phase 2 (first 2 weeks), specific information is targeted and can be collected through MDC if the tool is nimble enough for rapid deployment. Data collection techniques for these phase 2 inquiries continue to be key informant interviews and direct observation conducted at the community level, so the assessments should target these uses. It is also assumed that internet connectivity will not be consistently available in this early phase of a disaster, so tools requiring online data entry are excluded. Phase 3 allows for more planning and time for deployment, but is still time sensitive. A tight assessment requiring little setup and training can be deployed to a somewhat wider target population.

Some tools are more appropriate for a particular phase in the assessment process. As examined in the previous two sections, some MDCS require more time and effort to set up and configure. Some have a support network of developers and users that can assist a new initiative, while others require the users to work through the process themselves. Combining the information from the above

sections and assuming that no preparedness measures were taken, the MDCS have been divided into those appropriate for phase 2, phase 3, and those where the level of effort required makes them only appropriate for phase 4 (beyond the first month).

Rapidly deployable tools with support, suitable for phase 2	Tools with moderate set-up requirements or requiring internet, suitable for phase 3	Tools which should only be considered for phases 4 or 0
<ul style="list-style-type: none"> <li>• DevInfo EmergencyInfo</li> <li>• EpiSurveyor</li> <li>• GeoChat</li> <li>• Souktel AidLink</li> </ul>	<ul style="list-style-type: none"> <li>• Acqee</li> <li>• CSPro</li> <li>• CyberTracker</li> <li>• doForms</li> <li>• EpiCollect</li> <li>• KoBo</li> <li>• Majella Insight</li> <li>• Mobenzi Researcher</li> <li>• Nokia Data Gathering</li> <li>• Open Data Kit (ODK)</li> <li>• ViewWorld</li> </ul>	<ul style="list-style-type: none"> <li>• FrontlineSMS</li> <li>• Imogene</li> <li>• IMSMA<sup>NG</sup></li> <li>• openXdata</li> <li>• Pendragon Forms</li> <li>• RapidSMS</li> <li>• OASIS Mobile*</li> <li>• Voxiva HealthConnect*</li> <li>• Global Relief Technologies RDMS*</li> </ul>

\* Preliminary finding since full information on the tool was not made available for this study.

MDCS suitable for phase 2 would also be acceptable for phases 3 and 4 and beyond. Similarly those listed under phase 3 can be utilized in phase 4 and beyond.

Any tool intended to be used in a time sensitive situation should be tested beforehand. Administrators should be familiar with setting up the tool, creating forms, and deploying the mobile devices before attempting to use them in a phase 2 or 3 assessment.

## 6 DEVELOPMENT OF THE WEB DECISION TOOL

The web decision tool combines the objective data collected in the tool matrix with the questions shown in section 4.3. All of the tools in the survey are initially included. One question is presented on the screen at a time, with the ability to go back and revise answers. As questions are answered, the list of remaining MDCS is narrowed down by filtering on the database from the tool matrix. The web decision tool displays this list of remaining MDCS so that the user is aware of how their responses affect the results.

The decision tool questionnaire ends when all the questions have been answered or when the list is narrowed down to three tools, whichever comes first. The user is then presented with the complete set of data on these tools and links to their web pages.

The web decision tool is currently being constructed by the NOMAD team. It is expected to be publically available on the [NOMAD website](#) in January 2012.

## 7 MAINTAINING THE RESEARCH FOR THE FUTURE

Technology research surveys require frequent updates to remain current. Many of the tools covered in this research are actively being developed and altered. New features are added and existing capabilities expanded. A few times each year, an entirely new tool emerges and needs to be considered for inclusion in this review.

To facilitate ongoing collaborative updates, the research has been hosted on a shared Google Spreadsheet. A read-only share is available for the public, published on the NOMAD web site and distributed through the member organizations' contact channels. The fully editable spreadsheet has been shared with stakeholders and is a living document.

The NOMAD consortium is committed to the continued advancement of the application of mobile technologies with humanitarian actors. For this research to continue to be useful to humanitarians, it must be current. NOMAD is working with MobileActive.org to that end. Their work in mobile technologies and human rights keeps them aware of new tools, updated software, and ongoing projects with MDCS.

MobileActive.org will support NOMAD's maintenance strategy for the tool matrix knowledge base. This may include assisting with quarterly reviews of the matrix to add new tools, remove deprecated ones, and update for changes. MobileActive.org under its SaferMobile project is also working in parallel on a study of security features within MDCS. NOMAD is investigating how these findings can be integrated with the tool matrix and the web decision tool.

If you would like to provide additional information on a mobile data collection system, or if you wish to report an inaccuracy in the research data, please [contact the NOMAD team](#).

## 8 CONCLUSIONS

Mobile data collection is an emerging resource for humanitarian organizations looking to improve the efficiency, accuracy, and speed of running surveys. It can be a valuable approach for new projects or replacing existing paper forms. However, users will only find value in a mobile data collection system if an appropriate tool is matched to the team and project. The data and analysis presented in this research can help direct interested users to MDCS which fit their needs and goals.

The tool matrix spreadsheet contains the raw data necessary for comparing MDCS features and requirements. It can be scanned vertically to identify tools which meet a requirement, or horizontally to find the features of a particular tool. The visualizations components integrated with these MDCS are universally very basic. A few of the MDC visualization tools can provided simple graphs and charts, but power users will want to use outside analysis and reporting tools over the built-in options in these MDCS.

Developer support and user activity are important indicators of a MDCS's usability. Out of date tools with inactive user communities pose a risk to a project in case support is required. But these tools are still being used successfully by some organizations.

As a general rule, there is a tradeoff between ease of use and features supported. Highly customizable systems have more infrastructure pieces to install and configure. More basic tools can rely on turnkey installations, either through cloud hosting or one-step installations. The tradeoff is less apparent in the form creation, where more customizable tools are only slightly more complicated to use.

Rapid data collection for assessments in the early phases of a sudden onset disaster requires quick, no hassle installations. This study has identified four tools suitable for assessments in the first two weeks after a sudden onset disaster: GeoChat, Souktel AidLink, DevInfo EmergencyInfo, and EpiSurveyor. Each should be carefully evaluated and tested before attempting to use it in an emergency setting. Some of the cloud synched tools listed as appropriate for phase 3 can succeed earlier if internet connectivity is reliable.

The entry point into this research for most users will be the web decision tool on the NOMAD website. The simple interface allows non-technical users to obtain a short list of suitable tools from answering a few questions in plain English. Humanitarian MDCS evaluators can then use the more detailed information in the tool matrix as a starting point for follow-up analysis on the tools preselected.

## **9 SYNOPSES OF KEY MDCS**

The tools in this section have been identified by the NOMAD team as key tools worthy of more detailed descriptions. These MDCS are recommended, not for all users, but for the subset who match each unique tool's goals and requirements.

### **9.1 Imogene**

Imogene is perhaps the most complex MDSC reviewed, but also one of the most feature-rich. It requires IT expertise, including a long installation process on both server and client machines. The Eclipse based form builder includes most features, and is extendable with Java code. NOMAD tested Imogene on the second pilot project with IOM-Haiti in November 2011. Consider Imogene for complex surveys requiring bi-directional synchronization where time and IT resources are plentiful. Imogene was developed by MEDES, a NOMAD partner.

## 9.2 Open Data Kit

ODK is more than a tool, as it has become a standard platform utilized by many of the other MDCS reviewed here. An open-source project with the support of Google, ODK has an active development and user community. Local installation can be difficult, but the hosted cloud application on Google App Engine is very easy to implement. doForms, EpiSurveyor, KoBo, ViewWorld, and Majella Insight all include components of ODK.

## 9.3 KoBo

KoBo is a new tool quickly gaining momentum. Developed by the Harvard Humanitarian Initiative, the free tool is a customized combination of Purc Forms, ODK Collect, and other open source software. Forms can be developed online or offline.

## 9.4 FrontlineSMS

FrontlineSMS has a large user base of organizations requiring SMS only forms. It can be simple to set up in the best case, but many users report a troublesome initial experience. The developer support is very active. Frontline Forms is an add-on for more complex forms on Java enabled phones, though it isn't widely used. FrontlineSMS is useful for simple data collection projects with a medium set up period.

## 9.5 RapidSMS

More customizable than FronlineSMS, RapidSMS is also more time consuming to install and configure. It is built to the standard protocol from the Open Mobile Consortium (SPOMC). It is a better fit for large-scale, long-term projects which can budget for a longer development timeline involving skilled programmers. Negotiations with mobile carriers can also take considerable time. RapidAndroid is a UNICEF/Dimagi developed extension for Android devices.

## 9.6 ViewWorld

ViewWorld is a simple, quick, commercial tool with cloud hosting. The Android app is built on xForms / ODK, while the iOS version is proprietary. The forms offer a medium range of features with a low initial investment in configuration. It's suitable for early phase data collection if internet connectivity is good through GSM or WiFi.

## 9.7 Souktel AidLink

Souktel provides SMS based communications. Surveys are short and basic. Souktel provides services for the tool and assistance with form development. AidLink is simple enough to set up to consider it for phase 2 assessments in the first 2 weeks after a sudden onset disaster if tested beforehand.

### **9.8 Nokia Data Gathering**

Nokia Data Gathering is an established platform with ongoing development for Java enabled feature phones. These phones are cheaper and more widely available than smartphones, yet allow for more complex and structured forms than SMS based surveys.

### **9.9 EpiSurveyor**

EpiSurveyor is a well-established tool for collecting information on Java phones or through SMS. Android and Blackberry apps are available as betas, and an iPhone app is due soon. A limited free version is available for trial, with larger surveys requiring subscriptions. Data is stored DataDyne's cloud servers, and forms can be downloaded in the field. EpiSurveyor can be appropriate for phase 2 assessments.

## **10 NOMAD BACKGROUND**

NOMAD, short for Humanitarian Operations Mobile Acquisition of Data, is a collaborative project to study and advocate for the use of mobile information technologies in humanitarian contexts. Beginning in September 2010, NOMAD partners have been researching mobile data collection systems; actively engaging new partners in test projects; developing best practices and strategies for successful adoption of mobile technology platforms; and communicating these findings to the humanitarian sector at large. Complementing the research on MDCS in this report, NOMAD conducted two pilot projects. The first was in partnership with WFP in Ethiopia utilizing Imogene, OASIS, and Thuraya technologies. The second was with IOM-Haiti in November 2011, again using Imogene.

More on NOMAD's ongoing initiatives and the pilot projects can be found on the NOMAD website: <http://humanitarian-nomad.org/>. For assistance with specific advisory or implementation questions, the NOMAD team is available for consultation.

## 11 APPENDIX 1: MDCS REVIEWED

### NOMAD Preliminary list of Mobile Data Collection technologies

Tools and technologies considered for review. *Greyed boxes* are MDCS excluded from the full review and tool matrix analysis.

Category*	Tool / System	General notes from preliminary research	Tool, Service, Both?
DCI / GDP	<a href="#">DevInfo</a>	UNICEF developed tool, used for reporting on MDGs. EmergencyInfo module used for data collection on PDAs.	Tool - free
DCI / GDP	<a href="#">doForms</a>	new in April '11	Service
DCI / GDP	<a href="#">EpiCollect</a>	Android & iPhone app. Open Source & free. Can view reports/maps generated on the phone app.	Tool - free
DCI / GDP	<a href="#">EpiSurveyor</a>	Free version with limitations to quantity. Mobile app or via SMS (paid). (iPhone app fall '11). J2ME client built on JavaROSA is open source. Android client based on ODK is open source.	Tool
DCI / GDP	<a href="#">FLOW</a>	WatSan focus. Collects M&E data on wells and plots on Google maps. Cloud, SaaS.	Tool - free
DCI / GDP	<a href="#">GATHERData</a>	Last dev: Nov 2010. Based on XForms and JavaRosa standards. They provide services to combine open-source tools in custom configurations. Open source, end-to-end.	Service
DCI / GDP	<a href="#">IMSMA-NG</a>	IMSMA Mobile provides 2-way synch; works w/ laser rangefinder binoculars; Built on ArcPad (requires licenses) for Windows Mobile 6	Tool
DCI / GDP	<a href="#">Nokia Data Gathering</a>	Open source, runs on Java ME	Tool - free
DCI / GDP	<a href="#">openXdata</a>	Requires technical setup of server. BIRT reporting component is basic and not fully tested	Tool - free
DCI / GDP	<a href="#">Sahana Eden</a>	A "humanitarian platform" that seems to include XForm based ODK data collection as a component. Hard to tell what it actually does. The web demo doesn't work.	Tool - free
DCI / GDP	<a href="#">Voxiva</a>	Full-service solution, commercial dev and support.	Service

DCI/ Comms/ GDP	<a href="#">Global Relief Technologies</a>	commercial product: Rapid Data Management System RDMS. PDAs, tablets, or phones included. Optional hardware leasing.	Both
DCI/ Comms/ GDP	<a href="#">Majella Insight</a>	Optional Field System for rugged field networking. BlackBerry and Android, iOS coming soon.	Tool - Commercial + professional services
DCI	<a href="#">Acqee</a>	Browser based form generation and entry. Online only unless using Android connected to ODK Collect. Free trial, inexpensive monthly subscription for unlimited use.	Tool - commercial
DCI	<a href="#">Capture (formerly EMIT)</a>	Developed in S. Africa for collecting data on HIV / infectious diseases. A rebranding of OpenXData. Runs on Java phones.	Service
DCI	<a href="#">CSPro</a>	Limited features. Win Mobile (PPC) only. Wireless sync not supported, must be done manually. Developed by the US Census Bureau.	Tool - free
DCI	<a href="#">CyberTracker</a>	Icon based survey software. Windows PC software. Mobile app runs on PalmOS, PocketPC, or Windows Mobile. *Does not sync from device wirelessly.* Must connect to computer.	Tool - free
DCI	<a href="#">FrontlineSMS</a>	FrontlineForms works with Java devices. Can be hooked to Ushahidi for spatial analysis.	Tool - free
DCI	<a href="#">GeoAge</a>	Field Adapted Survey Toolkit (FAST) used in Haiti by the CDC and in Florida hurricane response	Both?
DCI	<a href="#">GeoChat</a>	Different paradigm: collaboration and communication rather than 1-way data collection. SMS, email, & Twitter. Could be used with InSTEDD's Riff tool for analysis/distribution.	Tool - free
DCI	<a href="#">IMOGENE</a>	Open source, Android, web and thick client. Built on Eclipse, so works on Linux/Win/Mac	Tool - free
DCI	<a href="#">JavaRosa</a>		Standard
DCI	<a href="#">KoBo</a>	ODK Collect extension, repackaged with Purc Forms and other tools. Allows for online or offline form designing. Map integration in development.	Tool - free
DCI	<a href="#">Mobenzi Researcher</a>	Formerly Mobile Researcher. Pay per survey.	Tool - Commercial



DCI	<a href="#">Open Data Kit (ODK)</a>	Open source, Android. Google supported	Tool - free
DCI	<a href="#">Pendragon Forms</a>	HTML 5 solution works on iOS, Android, netbooks, laptops, others...	Tool - Commercial
DCI	<a href="#">QRForms</a>	in development for OCHA-ISS by Dale Zak	Tool - free
DCI	<a href="#">RapidSMS</a>	-SPOMC standard protocol from the Open Mobile Consortium. -Large-scale, long-term projects, requiring negotiations with mobile network operators. - Requires skilled programmers and lengthy customization. - RapidAndroid UNICEF/Dimagi tool is an extension	Tool - free
DCI	<a href="#">Souktel AidLink</a>	SMS based tool for alerts or short, basic surveys.	Service
DCI	<a href="#">Sphinx</a>		Tool - commercial
DCI	<a href="#">surveybe</a>	Runs on laptops/tablets. Win XP or above	Both - commercial
DCI	<a href="#">View World</a>	Android and iPhone app upload through mobile network or WiFi Android app built on xForms / ODK iPhone app independent of ODK?	Tool - commercial (open source pending)
DCI	<a href="#">WFP PDA Survey</a>	MS Access db. PDAs running Windows ME 5 or 6	Tool - free
GDP	<a href="#">OASIS</a>	Mapping tool originally designed for security	Tool
Other	<a href="#">Ushahidi</a>	Crowdsourcing data aggregator	Tool - free
Other	<a href="#">Voozanoo</a>	Web only, no mobile component	Tool - free

\*DCI: Data collection Interface

\*Comms: Includes a satellite communication hardware system

\*GDP: Geodata portals and visualization systems