

Best Practices in Mobile Data Collection

Mobile Software Solutions

Software applications, or apps, are the nuts and bolts of mobile software solutions. Apps are the smartphone and tablet programs you use daily to compose email, update your calendar, edit documents and collaborate with colleagues. Most smartphones come loaded with the basic messaging apps like email, SMS (text messaging), calendars and contact lists, but you can download thousands of other apps to customize your mobile business experience.

One cost-saving example is using mobile data collection forms on smartphones and tablets as a replacement for clip boards and paper forms. Imagine using a mobile data collection app on your smartphone to accurately track the comings and goings of supplies just by scanning bar codes. Or using the smartphone's GPS to pinpoint a delivery location and adding it to the form. Or taking a picture of an item of interest, sketching on top, and embedding it right in a data capture form. Or recording video clips and audio notes and embedding them in your mobile forms. Then imagine being able to view, sort, map and integrate all these transactions with your other business applications and systems.

Mobile apps are not just a replacement for clip boards and paper forms, but a way to use 21st century technology to modernize the entire mobile data collection process. But in order to do so, the mobile business applications must be tailor-fit to each specific business process.

This is where do-it-yourself mobile software solutions may make sense. These are solutions that allow you to build your own mobile business applications, usually consisting of one or more mobile data collection forms, augmented with embedded images, video, audio, barcodes, sketches and GPS. These do-it-yourself solutions consist of (i) form creation software, (ii) data capture applications on mobile devices, and (iii) a form data website. This article examines some of the best practices with each of these components, as well as some of the deployment and support considerations for these do-it-yourself solutions.

Historically, the deterrent to using mobile devices in xyz, and realizing their functional advantages and cost savings, has been the significant investment an organization must make in software development and/or IT infrastructure. This is where turn-key do-it-yourself mobile software solutions come in. They eliminate this obstacle by enabling "average workers" to build, deploy and manage their own mobile form apps. No software programmers are required. And to make things easier still, many solutions supply a hosted IT infrastructure as well.

Saving Money by Using Mobile Business Applications

Functional advantages aside, the primary reason to spend money on mobile business applications is that they provide a very real and measurable return on investment. The average cost of a paper form with twenty questions, filled out manually, and later transcribed into a computer system, is between \$0.51 and \$1.88. Mobile data forms virtually eliminate these costs. Savings will be closer to \$0.51 for very large corporations that use offshore transcription. But for most small and medium size companies, their cost savings from mobile business applications will be closer to \$1.88, or even more depending on the factors discussed below.

Cost of Printing. The cost of printing/reproducing a monotone paper form with 20 questions using an office printer/copier....including the cost of paper, toner and depreciation of the office printer/copier We use an average of \$0.05 per letter size sheet. This cost is eliminated by using mobile business applications.

Transcription Labor Time. The labor time to transcribe the data from a paper form into a computer system, including wasted time from breaks and distractions. We use an average of 15 seconds per question, or 5 minutes per 20 question form. This is time saved by using data collection forms .

Labor Cost. The direct wages of an employee who would be doing the transcription above. This number is highly variable. We use an average of \$10 per hour for a data entry technician. These costs can be significantly higher if the transcription is done by professionals in your organizations “because no one else is available”. These labor costs are eliminated by using data collection forms because no transcription is necessary.

Fringe Benefits. These benefits, as expressed as a percentage of the direct wages above, include vacation, holidays, and sick leave; health and dental insurance; retirement contributions; disability and life insurance; worker's compensation insurance and employee wellness programs. We use an average equal to 20 percent of direct labor cost. So for each \$10 in direct labor cost, an additional \$2 in fringe benefits is saved by using data forms on smartphones and tablets. .

Overhead Costs. Overhead cost, as expressed as a percentage of direct wages, include rent (only for the space that employees use); depreciation of furniture and equipment; utilities (based on the space allotment for employees); and supplies that employees share. We use an average of equal to 80 percent of direct labor cost. So for each \$10 in direct labor cost, an additional \$8 in overhead is saved by using data collection on smartphones and tablets.

General and Administrative Costs. G&A costs, as expressed as a percent of direct wages + fringe benefits + overhead, include management (and associated fringe, direct, and indirect costs); legal costs; State and Federal taxes; certain marketing costs; accounting costs. We use an average of equal to 10 percent of direct wages + fringe benefits + overhead. So for each \$20 in direct wages + fringe benefits + overhead, an additional \$2 in G&A is saved by using a data capture form on a smartphone and tablet.

Save \$0.51-\$1.88 Per Paper Form. If you do the arithmetic using the cost factors above, the real cost of a \$10 per hour person transcribing data is \$22 per hour. And the average cost of a paper form with 20 questions that is transcribed into a computer system is \$1.88. If you do this same arithmetic using an offshore contractor at \$5.00 per hour, all inclusive (no fringe benefit, overhead or G&A), the average cost is \$0.51 per paper form with 20 questions. These are the costs saved by using a mobile business applications.

For an **FREE online savings calculator** where you can enter your own direct wages, fringe benefits, overhead and G&A costs to calculate your dollar savings, go to: <http://www.doforms.com/savings>.

What to Avoid:

- Over-promising near-term cost-savings which, while technically achievable, may be organizationally difficult to achieve. For example, while using mobile data forms on smartphones and tablets will eliminate the work of transcribing data from paper into a computer system, this may not translate into a lower head-count. The workers involved might simply be reassigned to do something else. So while there is a measurable cost savings, it might not manifest itself on a P&L until later, as a result of “future hires” not being needed.

Other Benefits of Mobile Data Collection

Mobile data collection has a number of other advantages over paper, including richer data, more accurate data, faster reporting, and enhanced data security. Mobile data collection also has measurable environmental benefits in the form greenhouse gas emission reductions.

Richer Data. Mobile data collection goes beyond the limitations of paper. Take a picture, then annotate it. Collect action video of an event. Record audio questions. Collect a GPS coordinate, then display it on a map. Scan barcodes to increase accuracy and reduce fraud. Receive instant form updates anywhere in the world during changing events. Mobile data collection forms allow you to do all of this with no need for software programmers or IT support staff.

More Accurate Data. This is accomplished through the ability to enforce real-time data entry checking. This checking may be in the form of checking value ranges (e.g., was the value entered within a valid minimum and maximum range). Or checking the format of the entered data (e.g. does the phone number include an area code). But the greatest accuracy gain is produced through the elimination of transcription errors by not needing to reenter data from paper forms into a computer system.

Faster Reporting. Mobile survey software saves valuable time. Imagine conducting a mobile survey without the delays of printing and shipping paper forms. You do not need to worry about paper forms being lost or damaged in transit. With mobile survey software, you do not need to reenter data into a computer because its digital to start with. So there are no reporting delays. Also, consider mobile software solutions that are hosted, so that you do not need to worry about the time required to set up and maintain servers.

Enhanced Data Security. While some will claim that there is nothing safer than printed materials, this is not always the case. Consider a situation where you must ship paper forms to/from underdeveloped countries, where such shipments may be lost in transit, stolen, damaged or held-up by corrupt customs authorities. Mobile survey forms that are communicated over the Internet eliminate these data security problems. And the forms may also be encrypted, providing security against unauthorized reading or tampering.

Environmental Benefits. Finally, imagine saving money and eliminating greenhouse emissions at the same time. The environmental cost of a single piece of letter size office paper is approximately 20.9 grams of carbon emissions. These carbon emissions are from the entire lifecycle of a piece of office paper, from tree cultivation and harvesting, to paper production, to waste disposal. And if you are a tree lover, for every 80,500 letter size pieces of paper saved, one tree is saved. Now that's green! For an online carbon emission savings calculator go to: <http://www.doforms.com/savings>.

What to Avoid:

- Over-promising non-tangible benefits which, while technically achievable, may be organizationally difficult to achieve. For example, enhanced data security will be difficult to achieve for a small organization whose IT is not up to par with state-of-the-art practices (a good reason to consider hosted solutions).

Now let's examine some Best Practices for the primary components of a mobile data collection solution.

Form Creation Software

A key part of any turn-key data collection forms solution is the ability to build mobile business applications that are specific to needs. Some mobile software solution vendors provide mobile app development services to their customers. Others provide customers with do-it-yourself forms creation software which they can use to build their own mobile data forms. And some offer both do-it-yourself forms creation software and mobile app development services, letting the customer choose what is best for their organization, given their current circumstances.

If you decide that mobile app development services are right for you, then consider the following best practices:

- ✓ Select a vendor that has demonstrable experience building mobile business applications that are similar to your needs.
- ✓ Select a vendor that can complete your mobile business applications in the required time frame.
- ✓ Select a vendor that is willing to work on both a time and material basis, and a fixed price basis, depending on the specific mobile business applications and the corresponding development risks.
- ✓ Select a vendor that provides you the ability to continuously review and comment on their work remotely through a website.
- ✓ Low price (or the "promise" of a low price) should be the last and least important of the criteria for selecting a vendor.

If you decide that the do-it-yourself approach is right for you, then be sure to look for the following best practices:

- ✓ Form creation software with a drag and drop graphical user interface which you do not need to be a specialist to use. You should be able to build your own mobile data collection forms with no traditional software programming required.
- ✓ Look for form creation software that is compatible with the W3C XForms XML standard which has been adopted by many mobile data collection leaders. This standard helps ensure compatibility and upgradability between mobile business applications.
- ✓ Look for mobile software solutions that provide a Forms Library with prebuilt mobile data collection forms that you can quickly modify for your particular needs.
- ✓ Look for the ability to preview mobile forms in a web browser to ensure that they work exactly as you want them to before deploying them to a smartphone or tablet.
- ✓ Be sure to answer "validity constraints" - both simple user interface and advanced interface using powerful "regex" expressions.

What to Avoid:

- Form creation software that is not compatible with the W3C XForms XML standard for interoperability.
- Relying on the do-it-yourself approach if your in-house-staff realistically do not have the time. This is a good reason for selecting a solution that offers a do-it-yourself approach, but backs this up with a la carte services in order to mitigate staffing peaks.
- Choosing a vendor mainly because they offer the lowest price. While always important, the “promise” of a low price is usually just that – a “promise” – and the actual cost can be something quite different.

Data Capture Form Apps on Devices

Data capture form applications (or “apps”) are the part of mobile software solutions that reside on the smartphone or tablet. . the part of the solution which you hold in your hand and allows you to enter data, take pictures, record video and audio notes, read GPS locations, scan barcodes, draw sketches and signatures.

Multiple Operating Systems. Be sure to look for solutions where the data capture form applications are supported on multiple operating systems, including iOS (iPhone and iPad), Android, Blackberry, and Window Mobile if you are in North America. Add Symbian (Nokia) to this list if you are in Europe. The advantage multi-OS support is that if you decide to switch or expand your use of mobile devices, you will be able to migrate your data capture form applications with little or no work.

Browser Independent. Look for data capture form apps for your mobile devices that work independently of a browser. These enable you to work in both connected and disconnected environments (for example, indoor or outdoor areas with iffy or non-existent cellular coverage). The app will need to connect with the Internet at some point to send its data, but it should also be able to operate independently of the Internet when a connection is not available. The app should also be smart enough to select the fastest and lowest cost data connection available...for example, WiFi over cellular, and cellular over satellite communications.

Hardware Integration. Look for data capture form apps that integrate directly with the mobile device hardware. This enables direct capture of pictures, videos, audio, barcodes and GPS. This hardware integration is the key to richer and more accurate data collection.

Any state-of-the-art data capture form application should provide, at minimum, the following features and functionality:

- ✓ Textual data entry
- ✓ Numeric data entry (integer, decimal)
- ✓ Date and time stamps
- ✓ Select one answer from a list
- ✓ Select multiple answers from a list
- ✓ GPS location coordinates
- ✓ Ability to add signatures
- ✓ Ability to sketch drawings
- ✓ Take picture images (with sketch overlay)
- ✓ Record video clips
- ✓ Record audio notes
- ✓ Scan barcodes (pay attention to formats: UPC, EAN, Data Matrix etc.)
- ✓ Make some questions "required"
- ✓ Set "default" answer values
- ✓ Set "remember" answer values
- ✓ Repeatable sections (loops)
- ✓ Question "skip" logic
- ✓ Question "relevance" logic

What to Avoid:

- Applications which are not compatible with the W3C XForms XML standard for interoperability.
- Applications that do not operate across a variety of mobile operating systems. You may need to, or want to, add devices running on different mobile operating systems, as the needs of your organization evolve.
- Mobile data forms that must work inside a web browser on your mobile device. These programs will not be able to operate in disconnected environments, and they will not be able to directly interface with the camera, audio and GPS on your devices.

Data Collection Forms Website

The data collection forms website is the part of mobile software solutions that aggregates the data sent from one or more smartphones or tablets used for mobile data collection. The data collection forms website is where you go to view, map and manage your mobile forms data. Some mobile software solutions vendors provide website server software that you install, run and maintain on your own server hardware. Other mobile software solutions vendors provide fully hosted websites. These are generally priced on a subscription basis, can be implemented almost immediately, and require less maintenance work.

Regardless of whether it is hosted or not, any state-of-the-art data collection forms website should support, at minimum, the following:

- ✓ Aggregates mobile forms data collected by designated mobile workers into "project" specific databases.
- ✓ Sorts and queries the aggregated mobile forms data based on value
- ✓ Plots mobile forms data records that contain GPS coordinates on a map
- ✓ Adds, edits, and deletes mobile forms data records (privileges dependent)
- ✓ Provides the ability to export mobile forms data to your other business applications (Google Docs, Excel, QuickBooks, OpenOffice, CSV, PDF, W3C XForms XML)
- ✓ Provides the ability to connect and integrate with your existing database, CRM and GIS business systems through the use SOAP web services (e.g., Oracle, Salesforce, ArcGIS)
- ✓ Is built on open standards (XForms XML, HTTP, SOAP)
- ✓ Allows you to control roles/privileges for different website users(e.g., Administrator, Project Manager, Editor, and View Only)

What to Avoid:

- Mobile data collection solutions that do not include a website where you can aggregate, view, manage and map your mobile forms data.
- Hosted websites where the ownership of your data is uncertain. The Terms of Use of the website should clearly stipulate that any and all data you collect belongs solely to you and will not be shared with any other party or used in any manner not authorized by you.
- Websites that do not provide a simple means of exporting your data to other business applications in a variety of industry standard formats (CSV, XML, etc.).

Deployment and Support of Mobile Data Forms

Key elements of successful deployment and support of mobile data forms include the ability to deploy remotely; the ability to control which mobile workers receive which mobile forms; the ability to control who can see or change data on the mobile forms data website; automatic mobile form updates; and robust technical support services for your mobile business applications.

Remote Deployment. Look for mobile software solutions that are designed from the ground-up for remote deployment. There are many methods of remote deployment. Solutions that download the mobile apps from the respective Android, BlackBerry or iPhone app store are generally the easiest. These app store interfaces have become almost as easy as making a telephone call. They also offer the advantage of automatic application software updates.

Control Who Receives Which Forms. Look for mobile software solutions that allow you to control which mobile workers receive which mobile data forms. An elegant system for doing this is using the notion of projects and forms. Specific projects contain specific mobile data forms. Selected projects are remotely assigned to each mobile device. Through such a system, different mobile workers can be provided with just those mobile forms that they need for their specific jobs.

Automatic Mobile Form Updates. Look for solutions where the mobile data collection forms are automatically synchronized with the mobile device. For example, if a correction needs to be made to a form, halfway through a project, the updated form(s) can be “pushed” out to and automatically synchronized with the mobile devices which subscribe to the project. The solution should be able to do this remotely.

Control Who Can See or Change Data. Look for mobile software solutions where access to the form data website is managed through the use of usernames and passwords, and specific roles/privileges assigned to website users. For example, roles/privileges can include Administrator, Project Manager, Edit Data and View Only.

Technical Support Services. Ideally, your mobile business applications would be so well engineered that technical support is never necessary. But such applications are extremely rare. So look for solutions that provide email and telephone support, wiki-style knowledge-bases, webinar training programs, and train-the-trainer programs. Keep in mind time zone differences if your workers are dispersed over several continents.

What to Avoid:

- Mobile business applications that require a two-step installation process: (i) download to a PC first and (ii) upload to the mobile device second. These are often confusing and error prone, thereby wasting your employees’ time, and creating unnecessary technical support burdens.
- Overwhelming your employees with too many apps through an “everybody gets everything” approach. While easier sometimes to deploy, this approach will result in user confusion and frustration.

- Mobile software solutions that require workers to bring their mobile devices to the office in order to have their mobile data collection forms updated.
- Mobile survey software that does not include robust technical support.

Mobile App Development Companies and Resources

Below is a list of mobile app development companies and resources for mobile data collection and mobile forms. While we do not recommend or endorse any specific vendor or organization, each website contains valuable information and some provide excellent case studies which you may find helpful.

Apacheta -- <http://www.apacheta.com>
Canvas Solutions -- <http://www.gocanvas.com>
Dexterra -- <http://www.dexterra.com>
Fivespark -- <http://www.fivespark.com>
Geoage -- <http://www.geoage.com>
Global Bay -- <http://www.globalbay.com>
Global Relief Technologies -- <http://www.grt.com>
inForm - www.skysoftsystems.com
Mobile Active -- <http://mobileactive.org>
Mobile Data Technologies -- <http://www.doforms.com>
Mobile Forms - www.devicemagic.com
MobileFrame -- <http://www.mobileframe.com>
Open Data Kit -- <http://opendatakit.org>
Open Mobile Consortium -- <http://www.open-mobile.org>
OpenROSA -- <http://openrosa.org>
Open X Data -- <http://www.openxdata.org>
Paper2Mobile -- <http://www.paper2mobile.com>
ProntoForms - www.prontoforms.com
Zerion -- <http://www.iformbuilder.com>

For more information contact Mark A. Jadowski, Ph.D., President, Mobile Data Technologies LLC
+1.207.951.6721 | mark@doforms.com | www.doforms.com