USE OF MOBILE TECHNOLOGY FOR MONITORING AND EVALUATION IN INTERNATIONAL HEALTH AND DEVELOPMENT PROGRAMS

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ABSTRACT

Kerry Bruce: Use of Mobile Technology for Monitoring and Evaluation in International Health and Development Programs
(Under the direction of John E. Paul)

Background

Mobile phones and other technologies are widely used in health programming in developing countries, many introduced by international nongovernmental organizations (INGOs) to accelerate data collection. This research examined; *How are INGOs adopting the innovation of mobile technology into M&E systems for health care programs in international settings, and what factors are facilitating or inhibiting this innovation?*

Methods

A mixed-methods approach employed key informant interviews with INGO leaders (n=12) and Platform providers (n=9) and an online survey of a broad sample of INGO personnel (n=311). The research used the Diffusion of Innovation (DOI) framework to structure the data collection.

Univariate and bivariate analysis of the quantitative data was conducted using SPSS Version 21 and qualitative analysis used MaxQDA Version 11.

Results

Of all survey respondents, 70.6% had used mobile technology overall during the last year, 77.2% were intending to use mobile technology over the next year in their programs, and 72.6% had

seen organizations like theirs using mobile technology. Only 55.7% had used mobile technology specifically for M&E applications in health.

Three of the five DOI areas—tension for change, innovation–system fit, and support and advocacy—showed INGOs to be far along toward the adoption of mobile technology. Assessing the implications of adoption and dedicating time and resources to the adoption—were relatively further behind.

Discussion

The research shows high levels of readiness for change in the INGO community. However, the full power of mobile technology to change the way M&E systems are built and how data are collected at a systems level has not yet taken hold. The high level of organizational readiness for change must be leveraged if organizations are going to adopt mobile technology into M&E systems. The researcher proposed a strategy to assist INGOs that would like to adopt mobile technology into M&E systems that includes disseminating the findings widely among research participants, platform providers, donors and the wider public and to repeat the survey research to track change over time.

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In the past, when I read the acknowledgements sections of theses and dissertations, I admit to thinking of students' thanks to their families as cliché. But until now I did not truly understand the sacrifice that those families had made.

This degree belongs as much to my loving husband, Thom, and my beautiful daughters, Mia and Hannah, as it does to me. My need to spend nights, weekends, and weeks away from home and, as during the push toward the finish, to spend days and days of time with my computer rather than with my family, is now in my past. Thom, Mia, and Hannah: I am so grateful for the time you have given me, and I look forward to rejoining our family adventures.

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As I worked toward it, I learned firsthand about the power of networks. First, there was the strong cohort of students who came together and rallied around one another in the program, seeing each other through even after the first group made it past the mark. To my colleagues—thank you.

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LIST OF ABBREVIATIONS

AEA	American Evaluation Association
AMREF	African Medical and Research Foundation
ANOVA	analysis of variance
CRS	Catholic Relief Services
CDC	US Centers for Disease Control and Prevention
DAI	Development Alternatives, Inc.
DOI	diffusion of innovation
DOTS	directly observed therapy, short course
DRC	Democratic Republic of Congo
e-FP	electronic family planning (information, services)
FHI 360	Family Health International 360
FP	family planning
GPS	global positioning system
ICC	intraclass correlation
ICT	information and communications technology
ICT4CHW	Information and Communications Technology for Community Health Workers
ICT4D	Information and Communications Technology for Development
IDEAs	International Development Evaluation Association
INGO	international nongovernmental organization
IRB	institutional review board
IRC	International Rescue Committee
IT	information technology
IVR	interactive voice response
JHPIEGO	formerly an acronym, now the name of an INGO working in maternal health

JHUCCP	Johns Hopkins University Center for Communications Programs
JSI	John Snow International
M&E	monitoring and evaluation
M-PESA	Kenya's mobile money system, where the "M" is for mobile and "pesa" is Swahili for money. M-PESA is also the name of a Kenyan company.
MSH	Management Sciences for Health
MSI	Marie Stopes International
NGO	nongovernmental organization
PDA	personal digital assistant
PEPFAR	US President's Plan for AIDS Relief
PSI	Population Services International
SEM	standard error of the mean
SMS	short message service
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USSD	unstructured supplementary service data
WHO	World Health Organization
WWF	World Wildlife Fund

CHAPTER 1
INTRODUCTION

Mobile technology may be poised to change the field of monitoring and evaluation (M&E) in international health programming. Every month, cellular voice and data networks reach farther into developing countries, and international nongovernmental organizations (INGOs) are increasingly using mobile technology in their programming. There were more than 6 billion mobile phone subscribers in 2012, according to the World Bank,[1] and a billion mobile broadband subscribers in 2011, according to the International Telecommunications Union[2]; 75% of the world has access to a mobile phone. The ubiquity of mobile phones is well illustrated in a 2013 quote from the United Nations News Center: "Of the world's 7 billion people, 6 billion have mobile phones. However, only 4.5 billion have access to toilets or latrines."[3]

This research surveys the status of incorporation of mobile technology into M&E systems in international health programming and its drivers to specifically to answer this question:

How are INGOs adopting the innovation of mobile technology into M&E systems for health care programs in international settings, and what factors are facilitating or inhibiting this innovation?

Definitions

Monitoring and Evaluation in INGO Systems

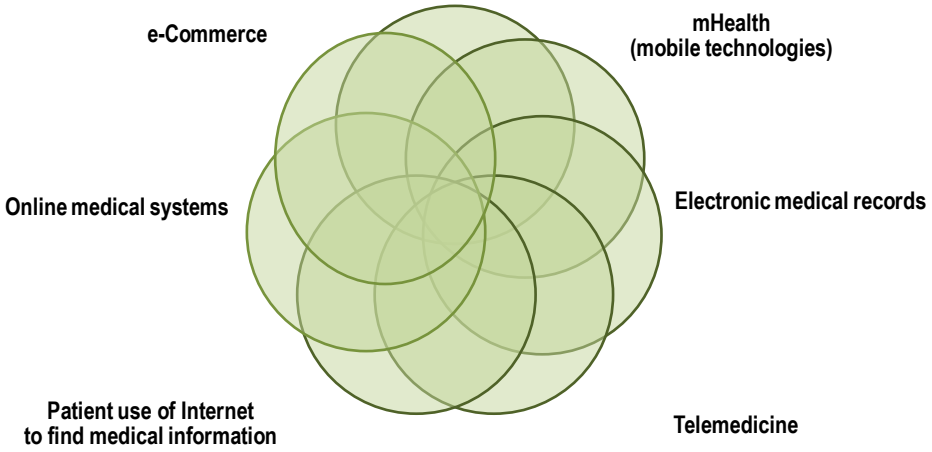
INGOs create M&E systems to be able to follow progress on their projects and ensure that they remain on track. These systems also help keep INGOs accountable to donors. The United

Nations Development Program (UNDP) defines *monitoring* as "the ongoing process by which stakeholders obtain regular feedback on the progress being made toward achieving their goals and objectives" and *evaluation* as "a rigorous and independent assessment of either completed or ongoing activities to determine the extent to which they are achieving stated objectives."[4] The systems created to collect and archive these data and use them for decision making and reporting are called *M&E systems.* A wider definition and an examination of the literature on these systems may be found in Chapter 2.

eHealth and mHealth

The term *eHealth* refers to the use of information technology to manage patient care[5] and more broadly to the "transfer of health resources and health care by electronic means."[6] The wide

Figure 1—Components of eHealth



range of services or systems comprising eHealth falls into six main areas (Figure 1): electronic commerce, or eCommerce, providing health services online or through electronic means; online medical systems; the use of the Internet by patients to find and access medical information; telemedicine; electronic medical records; and mHealth (mobile health).[7]

The term *mHealth,* often used interchangeably with *eHealth,* has been defined as "medical and public health practice supported by mobile devices such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices.[8] The term has also been defined as the "provision of health services and information via mobile and wireless technologies."[9] Defined this way, mHealth is a component of eHealth.

This study focused on a relatively small subset of mHealth practice—that is, how INGOs are using mobile technology in their M&E systems in health programming.

Diffusion of Mobile Technology

The diffusion of mobile technology in health is best illustrated by the growth of an Internet-based collaboration of INGOs who are sharing experience and information about this rapidly changing field via self-reports of mobile technology use for programming, the online mHealth working group (www.mHealthworkinggroup.org). This group now comprises 1414 members representing more than 450 organizations in 66 countries (Laura Raney, e-mail communication, August 5, 2013) and includes major INGOs. Table 1, an excerpt from a report funded by the United States Agency for International Development (USAID),[9] also highlights INGOs using mobile technology in health programming but does not indicate how or whether data are being incorporated into INGO M&E systems.

In health programs, INGO mobile technology use currently takes the following main forms:

- **SMS (Short Message Service) for data collection.** Allowing for limited data collection (one to 10 fields), this is most useful for rapid data collection or crowd-sourced data collection.
- **SMS to beneficiaries.** Text messages deliver reminders or health education messages to beneficiaries.

Table 1—Illustrative INGO Use of Mobile Technology in Health Programming

INGO	USE	TYPE OF MOBILE TECHNOLOGY USE	AREA
Population Council	Behavior change communication	Text messaging, hotline, social media, adolescent reproductive health	Kenya
Population Services International (PSI)	Behavior change communication	Hotline information on family planning	DRC
FHI 360	Behavior change communication	Opt-in SMS messaging on reproductive health	Kenya, Tanzania
FHI 360	Behavior change communication	Callback service for individuals most at risk for acquiring HIV infection	Ghana
PSI	Data collection	HIV testing and counseling service data	Zimbabwe
Management Sciences for Health (MSH)	Data collection	Community health worker follow-up	Rwanda
John Snow International (JSI)	Data collection	Pharmaceutical shortage early warning system	Ghana
Abt Associates / Marie Stopes International (MSI)	Financial	Voucher system for accessing reproductive health services	Madagascar
Pathfinder International	Service delivery	Screening tool for home-based HIV care providers	Tanzania
FHI 360	Service delivery	e-FP (electronic family planning): To improve the quality of counseling on family planning (FP)	Tanzania
JHPIEGO	Service delivery	Checklist for those providing care to pregnant women	Tanzania
JHPIEGO/D-Tree	Service delivery	Checklist for traditional birth attendants to support women in safe delivery	Tanzania
Abt Associates / JHPIEGO/ MSI	Service delivery	Guideline adherence messages for health care workers	Uganda
Abt Associates	Service delivery	Reminders for TB patients on DOTS (directly observed therapy, short course)	Nigeria
Johns Hopkins University Center for Communication Programs (JHUCCP) / MSH / FHI 360	Service delivery	Current health information for health care workers	Malawi

- **Electronic forms.**[i] Data or responses are collected via a form on a mobile device rather than through voice or SMS.
- **Mobile phones and tablets paired with other devices.** Pairing external devices such as medical instruments (e.g., devices to test blood or blood sugar), scanners, radio frequency identification tags, bar codes, or fingerprint scanners, with mobile phones and tablets.

When designed and used properly, mobile technology reduces or eliminates the need for paper data collection; reduces the need for secure transport of paper instruments from the source to a central data warehousing location; and lessens the need for data entry. Mobile technology

[i] Boyera et al (Mobile Data Collection in Africa). Some organizations in Africa are evaluating the potential of other technology: USSD (unstructured supplementary service data) and IVR (interactive voice response). These technologies hold potential but require a higher skill level to implement and are less commonly used.

collection platforms also make data available to an audience that is much wider than could previously be reached in real time or near-real time. At the same time, encrypted transmission and password protection of the aggregated data safeguard its security. Today's mobile technology, as represented by, for example, Android and iOS smartphones, by comparison to previously used, Windows-based PDAs, is more versatile: Communications capability is integrated, global positioning systems (GPSs) are often incorporated, and capturing images and voice as part of a dataset is feasible.

The Importance of the Research

Although INGOs are assisting national governments and local NGO partners to build and use mobile technology data collection systems,[10–12] how these INGOs are incorporating the technology into their own M&E systems is less clear. This research aims to fill this gap by examining how INGOs are adopting mobile technology into their M&E systems globally and what is driving or blocking adoption of the technology.

INGO Monitoring and Evaluation Systems

The vast collections of data managed by INGOs implementing health programs in developing countries take on different forms:

- **Data to monitor progress.** INGOs routinely collect monitoring data to keep abreast of how their programs are proceeding toward targets. Monitoring data are generally project specific, where data are collected to meet donor obligations for reporting and accountability.
- **Data for evaluation.** INGOs also manage process evaluation data that involve periodic, systematic reviews and measurement of the outcomes of the work. Process evaluation data are also generally project specific and are collected specifically for donors.

- **Data to document accountability and efficiency.** These data are administrative and process oriented and may be project specific or, like financial data or training databases, may cut across several projects or programs.
- **Data to assess overall organizational outcomes.** Increasingly, INGOs are interested in leveraging their M&E systems beyond donor or project requirements to move toward measuring the outcomes of their long-term work to understand its impact.[13,14]

Limitations and Potential Benefits of Mobile Technology Use

Limitations

Mobile technology is not a panacea. For a new M&E system based on mobile technology to be effective, INGOs must begin by carefully assessing the skill sets of those who will be using the technology as well as the availability of cell phone networks and access to electrical power supply, and then carefully designing the system and planning for training as required.

Mobile technology may not be universally appropriate. For example, although Africa is the second largest mobile market after Asia, with an estimated 650 million subscribers and 44 million broadband Internet connections, vast territories are still not covered via mobile phones,[15] and power for charging mobile devices also continues to be an issue.

Mobile technology may not be appropriate for all types of data collection. Typing long responses to open-ended or qualitative type questioning is cumbersome on a phone or tablet. To collect qualitative data, traditional methods are still preferable (although this might soon change).

All data collection systems must be carefully designed, and systems that use mobile technology are no exception. Indicator definitions must be common across programs, and linkages among the fields must be planned to ensure that data are comparable.[16] Still, differing ways of collecting data (e.g., numeric in one form and categorical in another) or differing indicator

definitions or disaggregation (e.g., children under five for one program and children under two for another) continue to hamper efforts to compare data from different contexts. Issues with systems' interoperability (i.e., the ability to move forms or data easily among platforms) and whether to use proprietary or open-source systems—both identified as major obstacles to be addressed in mHealth programming—must also be considered.[17]

The sustainability of mobile technology interventions is another potential limitation. Although project funding may facilitate the set-up of a data collection system based on mobile technology, the system may fail if the long-term costs of sustaining it have not been considered from the outset.[18]

Questions have also arisen around the ability of mobile technology to improve program outcomes. For example, some authors question the effectiveness of pilot projects and whether they will positively affect health outcomes.[16,19]

There are also significant concerns on the part of many countries about having "sensitive" data on their citizens, such as individuals' HIV status, hosted in remote locations. Given news in mid-2013 about the extent to which the National Security Agency is looking at phone records[20] and subsequent information about the extent of domestic reviews of data by the agency, this discomfort about data hosted outside national boundaries may only grow.

Potential Benefits

With a little forethought given to the system design, mobile technology can help overcome many issues plaguing traditional M&E systems. First, Web-based application hosting that can run software for customers on remote systems (sometimes known colloquially as "the cloud") removes some barriers of geography and function that have long impeded access to data and data sharing. Hosting of data on a Web-based server can extend data access to a wider pool of individuals who

can help analyze, disseminate, and use the data. As suggested by Tomlinson et al., mobile technology may also one day reduce the environmental degradation caused by the frequent air travel of public health professionals to provide technical assistance in different settings, allowing for support from a computer remote from the work site.[19]

Second, by consolidating data collection and data entry, mobile technology also expedites digitization of data, and faster data processing no longer delays data use.

Third, because of the systems of checks and skip patterns that can be built into mobile technology data collection systems, data are cleaner; mobile technology can ensure that all data are entered in the same configuration, thus allowing for seamless download into formats, such as Microsoft Excel™, usable by most INGO staff.

Fourth, mobile technology can also help to harness "big data" more effectively—permitting data aggregation and analysis across projects—and thus can facilitate systematic examination of the results of an overall approach as well as the results of discrete projects. Such an approach-oriented analysis will help INGO staff understand the impact of a whole body of work; managers can measure and know more about their businesses and can translate that knowledge into improved decision making and performance.[21] Although not all INGOs have an interest in data-driven metrics, several major INGOs are using private funding and other resources to invest in measurements of their approach and impact beyond individual projects.[13,14]

Before mobile technology for M&E becomes an expected intervention on the part of donors and senior INGO management, a clear understanding of where organizations are in the adoption process and the drivers and barriers to that process is crucial.

CHAPTER 2
REVIEW OF THE LITERATURE

The narrow selection of topics in this literature review describe the incorporation of mobile technology approaches into the M&E systems of INGO health programs following a diffusion of innovations (DOI) model. First, an overview of literature describing M&E systems in INGO programs will provide a brief description of these systems' goals and structure. A second overview looks at the literature describing how mobile technologies have been used in international health programs broadly and how this use relates to M&E systems. Finally, a review of a selection of the key literature relating to DOI will provide a model for understanding whether and how the innovation of mobile technology is ready to be adopted into INGO health programs' M&E systems.

Monitoring and Evaluation Systems in INGOs

This part of the literature review began with a search in Google Scholar, using the terms *monitoring and evaluation system* and *monitoring and evaluation handbook* and *monitoring and evaluation manual*. Because most literature on M&E systems is not academic, the search was repeated on Google Search, yielding a larger number of the handbooks and manuals that INGOs use for training and to ensure standards in their organizations.

Many books and handbooks and a few journal articles have been written on how to build an M&E system, especially in international development settings. There are handbooks relating to health and HIV,[22–25] to human resources for health,[26,27] to governance,[28–31] to participatory monitoring and evaluation,[32,33] to monitoring of poverty reduction,[34] to donor views,[35] and to general systems.[4,22,36,37]

Kusek[28] summarized the essential actions in building an M&E system:

- Formulate outcomes and goals.
- Select outcome indicators to monitor.
- Gather baseline (and subsequent) data on the situation.
- Set specific targets and deadlines for reaching them.
- Regularly collect data to assess whether targets are being met.
- Analyze and report results.

Typically, M&E systems focus on individual projects, rather than on approaches or sectors,[35] because individual donors require reporting of results to account for how funds were spent. Increasingly, INGOs are trying to create M&E systems with validity and utility beyond the needs of individual donors; such systems are most likely to be created when a pool of funding addressing an issue occurs for multiple country contexts. A good example of this was the Track 1.0 funding of the US President's Emergency Plan for AIDS Relief (PEPFAR), which closed out in 2012. Several partners implementing Track 1.0 programs had the foresight and funding to measure indicators in systems longitudinally and to make better use of remotely operated or cloud-based systems that expanded access to the data and made analysis of outcomes and approaches more practical.[10] Other examples of M&E systems based on an approach and moving beyond a project focus include those that INGOs have built that seek to measure agency outcomes and impact.[13,14]

Mobile Technologies in Health Program M&E Systems

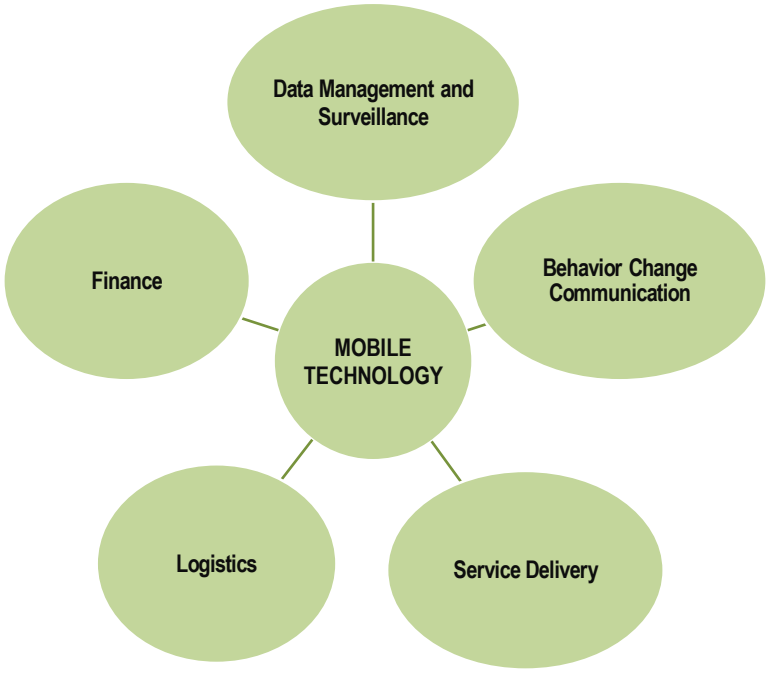
Three methods were used for this part of the literature review. First, the peer-reviewed literature catalogued by PubMed and Web of Science was searched using the terms *mobile phone data collection* and *monitoring and evaluation systems in developing countries*. Second, to broaden the range of articles returned, the search was repeated in Google Scholar. Then, because few directly relevant articles or reports emerged, the selected article reference lists were reviewed and

a “snowball” technique was used to identify Internet sites that housed INGO literature and reports published on Internet sites and not peer reviewed (the so-called gray literature). Articles not directly relevant to the use of mobile technology to improve data collection and management in international settings were excluded.

This literature review did not cover all the numerous published articles concerning the uses of mobile technology for health service delivery. Rather, it targeted how the INGO community is beginning to use this technology, with an eye toward understanding how it will be used in the future, especially in M&E systems.

It became clear that INGOs are supporting national governments in developing countries to build mHealth systems of many types—hotlines and call centers; message systems to support

Figure 2—Uses of Mobile Technology in mHealth



treatment compliance, provide appointment reminders, mobilize communities, and raise awareness; systems to manage data, conduct surveys and surveillance, and monitor patients; and

decision support systems.[8] It remains unclear, however, how INGOs are incorporating mobile technologies into their own systems, especially their systems for data management. The literature shows typical mobile technology usage grouped into five major categories (Figure 2): usage for data management and surveillance; usage for behavior change communication; usage for service delivery; usage for logistics; and usage for finance. Each category represents a type of data collection or use that might form a part of an M&E system.

Mobile Technology for Data Management and Surveillance

Many of the most comprehensive studies examining applications of mobile technology in developing country settings are the result of partnerships between academic institutions and governments. The most closely aligned published example of mobile technology applied to M&E settings describes the work of an institution that is not actually an INGO, Indiana University, which is implementing primary health and HIV care programs in western Kenya; mobile phones were used to collect data for surveillance of the target population. Proprietary forms were created via OpenDataKit, and Android smartphones were used for data collection. The data were linked to existing electronic medical records and mapping software, and bar code scanning identified respondents at community level. The published study describing this program gives a great level of detail on how the system was constructed and planned, although it had not been fully implemented at the time of publication.[38,39] There is at least one national-level example of the use of mobile technology to improve national M&E systems: Rwanda's Web-based TRACnet reporting system[40]—built with technical support from an academic center, Columbia University (again, not actually an INGO). TRACnet uses solar-powered mobile phones for data collection.[10,41]

A 2009 study that describes how custom applications built on Google's Android platform were used to collect data also describes how this technology could help to encourage "citizen scientists" to contribute data using the mobile phones in their pockets.[42]

In 2012, funded by the mobile technology company France Telecom/Orange, the World Wide Web Foundation undertook a study to understand how organizations were using mobile phones to collect data in Africa.[18] They found two main modes of collection:

- **With agents.** Staff or enumerators from the organization collect data on behalf of the organization.
- **Without agents.** Data are sourced directly from the community or the population.

The foundation uncovered limitations to both methods and observed that organizations using the technology made a choice to use one or the other method of data collection based on the type of information required. Four key challenges to implementing mobile phone programming were identified:

- **Language.** Ensuring that the appropriate language character sets were available for the application was essential to ensuring reliable and valid data were collected.
- **Miscommunication and misunderstanding.** Privacy was identified as an issue, along with trust. In data collection exercises, it was found that the respondent must feel that the data would not be used in a scam. Questions need to be field tested to ensure that there is a common understanding of the meaning of each question and that the responses provided as options are appropriate.
- **Funding and momentum.** Maintenance of systems and continued technical support for data collection systems to ensure their continued use and viability were critical.
- **Inconsistency of basic services.** Erratic availability of electricity and Internet connectivity caused problems with data collection on an expected schedule.[39]

As pointed out by Piette et al., "Deploying community-wide systems is much more complex than deploying [systems for] smaller or shorter-term pilot projects," and "To avoid fragmentation, poor communication, and poor interoperability, integration with existing systems is vital."[43] This

need for platforms' and systems' interoperability, especially in the global context, may prove an obstacle to wide adoption of the technology and ability to share information from different settings. There is international concern at the World Health Organization (WHO) that without agreements and policy that will permit harmonious data flow, permanent "eHealth silos" will be created. These silos would mean, for example, that international malaria data might not be compatible with child mortality data or that international real-time data systems would be incompatible with national government systems, obviating the gain that could be achieved through better real-time data.[8] The same WHO report also calls for ensuring global architecture and standards for mobile technology that will allow information to flow more seamlessly in the increasingly global economy. In January 2013, the WHO Executive Board submitted a resolution to the World Health Assembly urging member states to develop overarching eHealth strategies and standards that would facilitate interoperability and free exchange of data.[44] It remains to be seen how this resolution will be operationalized. Also on the issue of interoperability, there were editorials in *Health Affairs* and *PLoS Medicine* in 2010 and 2013. Both editorials called for standards for global interoperability to ensure ease of data transfer among countries.[17,45]

Overall, the literature has high praise for the improved timing of data collection using mobile technology as well as its accuracy and acceptability.[42,46,47] One study found that the frequent collection of data, when shared with civil society, led to discussions and closer-to-real-time use of the data.[48] The researcher who expressed concerns about the accuracy of data collected via forms compared to data collected via text or voice[49] appears to be in the minority.

Mobile technology has been effectively integrated in medical and health early warning systems in clinical trials in Peru to create an "effective surveillance system that gives real-time data, rapid analyses of data, and communication back to the field to coordinate response."[50] SMS data

collection has also been recommended for use in continuous monitoring in infectious disease surveillance programs.[51–55]

There are examples of data collection platforms that use enumerators to collect data, but also—increasingly in conflict and emergency settings—platforms that allow community respondents to report an emergency, conflict, violation of election practice,[56] or even cases of disease.[57]

Mobile Technology for Service Delivery

Many mobile technology applications used by INGOs are designed to deliver patient reminders and to facilitate patient tracing. A study in Uganda looking at methods to improve patient attendance for HIV clinical care follow-up found SMS reminders to be potentially efficacious.[58] In a randomized controlled trial in Kenya that looked at patient attendance for HIV clinical care using a reminder system, a significant relationship was found between patients' receiving reminders and their attending appointments, resulting in better health outcomes.[59]

In a review of seven studies on the efficacy of SMS reminders to patients, including four randomized controlled trials, SMS reminders were shown to improve adherence rates.[60] However, other evaluations of the efficacy of SMS to improve attendance at follow-up visits have been mixed.[61] There was no clear outcome in a trial of SMS compared with interactive voice response (IVR) to measure pediatric adherence to antiretroviral therapy.[62] In Mexico, a public–private partnership is developing SMS patient health education messages and clinical care follow-up reminders appropriate to conditions ranging from HIV to heart health to diabetes, and although this reminder program has not yet been rigorously evaluated, it is expanding nationally.[12] SMS technologies have been proven effective in some settings for reducing the length of time it takes to receive and act on patient data—sometimes dramatically lowering it to two minutes from between one and three months.[11]

The literature also provides examples of the use of mobile technology to support clinician decision making. For instance, to ensure that the decisions made by clinicians on behalf of patients are evidence based, organizations have developed systems to provide access to better data and other information.[63] Community health workers can now rely on support from mobile technology to screen patients.[38] Mobile technology has also been used to strengthen human resource capacity, through training and information sharing.[64]

Mobile Technology and Behavior Change Communication

Some mobile technology systems focus on promoting positive health behavior. For example, TexttoChange.org, piloted in Uganda in 2008, started with a series of four-week education programs using SMS messaging. Each program started with an SMS announcement targeting a given region's group of mobile users and encouraging them to opt in to a questionnaire. Participants were then sent multiple-choice quiz questions as SMS messages. They received mobile phone calling credit as an incentive for participation and were then sent HIV education messages, which were reinforced by repeated quizzes. TexttoChange.org subsequently expanded the scope of its program to include medication reminders, data collection, and the like.[65]

One Cochrane review explored how SMS messaging can facilitate self-management in long-term illnesses. According to the criteria for inclusion in the review (restricted to experimental or quasi-experimental designs), only four studies were identified for inclusion, with a total of 182 participants.[66] Although additional studies that nearly met the inclusion criteria were found (n = 31), the paucity of studies utilizing experimental or quasi-experimental design illustrates the low level of rigor in evaluating this field. Of the studies included in the review, none were in developing countries and only two of the 31 nearly meeting the criteria were in developing countries. Although the authors open their review by noting the importance of mobile technology to low-resource settings, almost none of the research actually took place in those settings.

Mobile Technology for Logistics and Commodity Tracking

Mobile technology has been widely used for commodity tracking internationally. Most literature relating to logistics and commodity tracking is not peer reviewed. In fact, only a single peer-reviewed article was identified; it discussed the pairing of a temperature-monitoring sensor with a low-cost phone.[67] Descriptions of the use of mobile technology for commodity tracking that were not peer reviewed documented applications in family planning[68,69] and general logistics management information systems.[70–72] There have been calls for further development of commodity tracking and pharmacovigilance using mobile technology, especially in the field of malaria—a field that has seen a proliferation of counterfeit drugs.[73]

Mobile Technology for Finance

Mobile technology companies throughout Africa are offering mobile money services using a non-banking model. These mobile financial applications allow registered users to deposit an amount of money with the mobile phone provider that holds the money in trust and then use that money to pay bills, trade, and send money to other people. Although most of the systems in Africa are currently owned by mobile service providers, many countries around the world are also developing bank-led mobile models.[74] In an analysis of the potential household-level economic impacts of Kenya's M-PESA mobile money system, authors found that small infusions of money via M-PESA during a health shock had the potential to avert larger consequences for a family.[75] Much of the literature on the use of mobile money concerns the effectiveness of conditional cash transfers to effect a change in health outcomes,[76] rather than on the technology itself. The effect of how people get the money—whether via mobile phones, via voucher, or via direct cash payment—has not yet been comparatively studied.

Over the long term, although mobile money services will undoubtedly be useful for the development of cash transfer and service programs, the implications of promoting and using a

mobile money service that does not pay interest and is often not regulated by a nation's central bank could be problematic.[77] Conversely, mobile money programs started by health programs may have unintended positive consequences. One study found that mobile money empowered rural women by enabling them to access resources (from partners and urban contacts) and that fully 30% of rural users of a mobile money system reported increases in income.[78] Mobile money is allowing capital to penetrate more effectively into rural areas than was previously possible.

Diffusion of Innovations

There is a wide-ranging literature on DOI as it relates both to health and to the adoption of technology. The main author on this topic is Everett Rogers. His seminal work over more than a quarter of a century—to study and describe the diffusion of innovations—is critical to understanding the process of how an innovation is adopted within an organization. Rogers identifies five key stages in the innovation process in organizations.[79]

- **Stage 1, Agenda Setting**, where organizations note there is problem and may require a change.
- **Stage 2, Matching**, where a solution to the problem (i.e., an innovation) is found.
- **Stage 3, Redefining/restructuring**, where the innovation is made to fit the organization's systems and structures.
- **Stage 4, Clarifying**, where the organization comes to clearly understand the innovation and how it fits within the organization.
- **Stage 5, Routinizing**, where the innovation has become part of the organization's day-to-day routine.

According to Rogers, the organization is in an "initiation" phase during the first two stages of this process and moves into the implementation phase between stages 2 and 3, when it makes the

decision to adopt the innovation. The process might not always be linear—sometimes the organization decides to adopt an innovation even before fully defining the problem (Figure 14).

Rogers' work on the diffusion of innovations is broad, and the literature review for this research targeted systematic reviews focusing on DOI in the field of health in service delivery organizations. Although several review articles were found,[80–82] Greenhalgh et al. focused particularly on DOI in service organizations and systematically examined the literature directly related to adoption of innovations in these settings.[83] Thus, the Greenhalgh review, which further recommended areas that would benefit from additional research on DOI, was selected as the conceptual model for this research and as the main focus for the literature review.

Greenhalgh et al. defined innovation in service delivery and organizations as "a novel set of behaviors, routines, and ways of working that are directed at improving health outcomes, administrative efficiency, cost-effectiveness, or users' experience and that are implemented by planned and coordinated actions." In the review, the authors noted six broad categories of findings in the DOI literature:

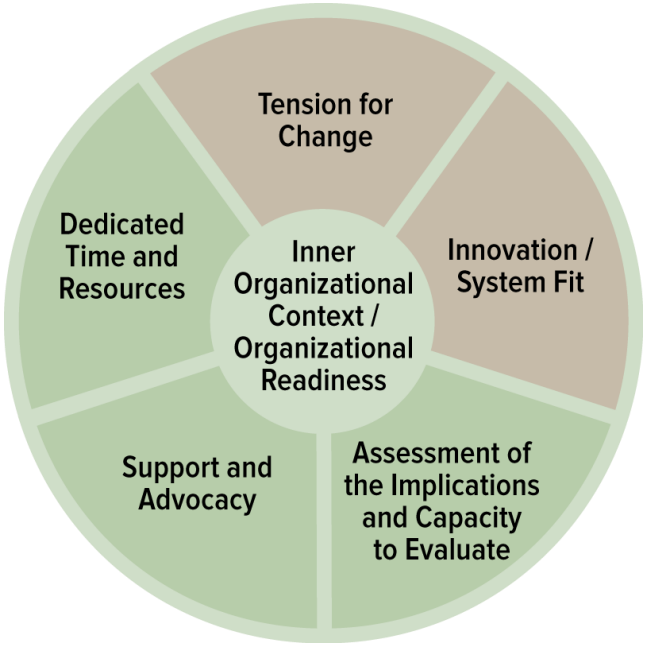
- The innovation itself.
- The adoption/assimilation process.
- Communication and influence of the innovation—that is, its diffusion and dissemination by social networks, opinion leadership, champions, and change agents.
- The inner (organizational) context of the innovation, including both antecedents for innovation in general and readiness for particular innovations.
- The outer (interorganizational) context, including the impact of environmental variables, policy incentives and mandates, and interorganizational norms and networking.
- The implementation process.

In the review's recommendations, one area highlighted for additional research was the inner (organizational) context and how it influences the adoption of innovations.

Within the inner organizational context, there are five major subcategories (Figure 3). Two of these, tension for change and innovation–system fit, are similar to the agenda-setting and redefining/restructuring activities described by Rogers.[79]

- **Tension for change.** In other words, do members of the organization find the status quo so untenable that they are convinced of the need for change?[84] Tension for change can also be equated with Rogers' attribute of relative advantage—the degree to which an innovation is perceived as being better than its precursor.[85]
- **Innovation–system fit.** In other words, does a given innovation fit with existing organizational systems and make the systems' operations easier and more efficient?[79,84] Innovation–system fit encompasses Rogers' concepts of compatibility (the degree to which an innovation is perceived as being consistent), complexity (the degree to which an innovation is perceived as being difficult to use), observability (the degree to which the results of an innovation are observable to others), and trialability (the degree to which an innovation may be experimented with before adoption).
- **Assessment of the implications.** The literature described in the systematic review revealed that organizations that had fully assessed the implications of adoption of an innovation were more successful in assimilating it.[79,84] The literature also identified the capacity to evaluate the innovation, which is closely related to an assessment of its implications. If the organization set targets and was committed to evaluating the outcomes of implementing the innovation, it was more likely to be adopted.[79,84,86]

Figure 3—Dimensions that Affect the Diffusion of Innovation in an Organization



- **Dedicated time and resources.** When an organization devoted time and resources, especially continuing resources, to an innovation, the chances of its being adopted increased.[79,84]
- **Support and advocacy.** Adoption of an innovation was more likely if leadership and management were behind it or if it had internal champions.[79,84,87]

Together, according to the literature, these factors work in coordination to affect overall organizational readiness for change around the adoption of innovations.

Organizational Readiness for Change

Complementing the diffusion of innovations literature is an additional body of work on organizational readiness for change. This literature intersects with the DOI specifically in the organizational readiness component. In a review of the literature on organizational readiness for change in the health field, Weiner et al. note, "Collective and coordinated behavior change by many organization members is often critical for the organization change effort to product tangible benefits."[88] Weiner defines organizational readiness for change as "the extent to which

organizational members are psychologically and behaviorally prepared to implement organizational change" and notes that it is a "multilevel and multifaceted" construct.[89] In the same paper, Weiner posits a theory on how organizational change occurs, looking at a trio of constructs: change efficacy, change commitment, and contextual factors. In later work, Weiner and his colleagues developed and tested a tool for measuring organizational readiness for change based on these constructs (Bryan Weiner, e-mail communication, March 18, 2013).

Discussion of the Literature

Very little literature specifically examining the incorporation of mobile technology into INGOs' M&E systems was found, although much of the literature is directly relevant to M&E systems. The review revealed the closest approximation of the development of INGO M&E systems to be in the programs conducted by Indiana University in Kenya and Columbia University in Rwanda (page 12).

Relevance to Mobile Technology to M&E Systems in Health Programs

The relevance of data collection and surveillance to INGOs' M&E systems is strong. Data collection and surveillance systems can often be a major source of monitoring data and may serve as the basis for the development of larger M&E systems. Service delivery is also relevant to M&E systems, as service delivery data can be directly incorporated into M&E systems alongside other monitoring data. In addition, information on service delivery outcomes can reveal whether programs are achieving their goals and having the intended impact. Information obtained from the use of mobile technology for behavior change communication and from service delivery can prove important as a source of data for monitoring a program, showing how many people have been reached and with what messages. Systems that enroll participants into a system can provide "just in time" messages for related health conditions. Mobile technology allows measurement (e.g., of enrollees to a service) with more precision (through the ability to document images, geocodes, or

more basic information) and more alacrity, and can facilitate direct follow-up with the target population. In addition, there is some limited evidence that collecting data via mobile phone is cost-effective.[48]

The use of mobile technology in logistics and commodity tracking is directly relevant to its use for M&E systems. Data that used to be collected via slow, paper-based systems are moving into real time and are available sooner to program managers, enabling these managers to better use data to make decisions and target problem areas.

Mobile technology's current use as a financial tool is relevant to M&E systems because it provides a link to costing data and may allow for costing analyses—a traditional weakness of INGOs, which often house financial data and program data in separate, unlinked systems.

The Diffusion of Innovations and Mobile Technology in Health

No authors have looked at mobile technology using a diffusion of innovation lens to frame the analysis. While authors have used DOI to look at the adoption of innovation in health services research, it has not yet been done for mobile technology and more specifically has not yet been done to examine how mobile technology uptake is happening for monitoring and evaluation systems.

Limitations of the Literature Review

This literature review likely underrepresents INGO efforts to implement mobile technology innovations. Documentation of these efforts is largely unpublished or not accessible on the Internet. INGOs are continuing to introduce mobile technology into small-scale, short-term pilot projects and may still be struggling to develop architecture and systems to help them take applications to scale.[16] INGOs are also not incentivized to publish information on their processes as it may damage their

competitive advantage in a field. Although more information may exist in INGOs' internal archives, it is not available to the public.

Questions That Remain about Mobile Technology

Although the relevance to M&E systems of current mobile technology uses in health programs is clear, a number of questions remain. For example, we still don't know whether INGOs see these individual uses of mobile technology as stand-alone or whether the technology is insinuating itself more broadly into other functions of the organization, including M&E systems.

How the innovation of mobile technology is being adopted into INGO M&E systems is also opaque. Whether INGOs are following a specific strategy or allowing for a less systematic adoption of the technology and whether organizations (rather than individuals) are adopting the change is not clear from the literature.

INGOs are often entrusted with bilateral funds intended to support mobile initiatives.[90] The quality of INGOs' stewardship may ultimately depend on the organizations' familiarity with and readiness to use these technologies within their own systems. There needs to be a better understanding of how widespread the adoption of mobile technology is within INGO M&E systems. Indeed, there needs to be an understanding of the state of the field generally and how INGOs are leveraging existing programs to build M&E systems using mobile technology.

CHAPTER 3
STUDY DESIGN AND METHODOLOGY

The literature review, described in Chapter 2, revealed a paucity of peer-reviewed publications on the adoption of mobile technology into INGOs' M&E systems. Although evidence of wide mobile technology use by INGOs does exist, there is no clear indication of exactly how widely this innovation has been implemented, nor of whether implementation has been primarily for service delivery or as part of M&E systems.

A broad understanding of the state of INGO adoption of mobile technology into M&E systems is needed, as is an understanding of how this adoption is taking place and whether we are at a tipping point for organizational adoption of this technology into M&E systems. The design for the present research follows from these observations. The research question is:

> *How are INGOs adopting the innovation of mobile technology into M&E systems for health care programs in international settings, and what factors are facilitating or inhibiting the innovation?*

Answering this question will help to bridge gaps in the literature.

Conceptual Framework

To answer the research question, the starting points were the diffusion of innovation conceptual framework described in Chapter 2 (as a means to understand the adoption of the innovation and building an understanding of organizational readiness for change). Specifically, the literature review helped inform the development of questionnaires that sought to answer the aforementioned research question and also to investigate the specific aims of the research:

- To understand whether INGOs are allowing ad hoc diffusion of mobile technology or are guided by a formal strategy.
- To understand whether INGOs have met the prerequisites for organizational readiness to adopt mobile technology as an innovation.

Specifically, questions focused around each of the five DOI subcategories and the organizational readiness for change criteria identified in the literature.

Questions Relating to the Diffusion of Innovations

Tension for Change: Questions for this part of the research focused on direct observation of mobile technology by respondents and their level of conviction that data collection using mobile technology would improve the organization's M&E system. Questions also examined whether staff at all levels in the organization saw and understood how they might use mobile technology to improve their data collection capability. Questions as to whether ease of use affected adoption and about the need for data quality and timeliness were addressed.

Innovation–System Fit: Questions for this part of the research focused on whether the innovation fit with existing organizational systems. Questions were asked as to the compatibility and interoperability of mobile technology with current systems and how systems could be sustained. The ease of use, the ability to seek and obtain information on technology applications, and questions on the complexity of change were posed.

Assessment of the Implications and Capacity to Evaluate: Questions in this part of the survey focused on any assessments or evaluations of the technology that the organization had conducted and whether goals or targets for adopting the technology had been set. Specifically, questions about policy and strategy and whether they were formal or informal were included. The role of evidence and pilots was also considered.

Dedicated Time and Resources: Questions here focused on whether the organization had devoted time and resources (especially overhead resources rather than project-based resources alone) to mobile technology. There were some questions about the absorptive capacity for new knowledge, specifically looking at where the adoption of mobile technology is sited within INGOs and whether it is the responsibility of a single department or several. INGOs' policy-setting protocols were examined to understand whether policy supported resource integration and allocation.

Support and Advocacy: Questions in this section asked whether leadership and management backed the adoption of mobile technology and whether leadership directly supported the use of mobile technology in M&E systems. Questionnaires asked whether there were, within the organization, champions of mobile technology and people to link potential users with resources or outside entities who could provide assistance. There were also questions on network structure, which aimed to reveal the presence and influence of colleagues at other INGOs who were using mobile technology data collection methods in their M&E systems. The influence of opinion leaders and the readiness of leaders within organizations to adopt the innovation were also considered.

Organizational Readiness for Change: Finally, questions using the organizational readiness-for-change tool developed by Weiner and his colleagues were included, in a twin effort to understand the readiness of the INGO community for adoption of mobile technology and to conduct an assessment of INGOs that had multiple respondents to the survey to see where they fell on the readiness scale in comparison to one another and to the community as a whole.

Study Methods

Based on the literature and the conceptual framework, questionnaires (Appendices 1–3) were designed to address both the adoption of mobile technology as an innovation and the facets of organizational readiness for change. Semistructured interview guides and a structured questionnaire were developed to collect information from INGO interviewees to answer the

research question and to address the specific aims. A mixed-methods approach employing an iterative design was used. First, key informant interviews with INGO leaders working in health sought to collect information on the research questions, but results were also used to frame and refine an online survey administered to the wider population of INGO workers in health. Next, the online survey of INGO employees about their experiences adopting mobile technology into their M&E systems was conducted. Third, key informant interviews with platform providers were conducted to triangulate and deepen the initial interviews and survey results.[91] The results from each source of information were joined together to answer the research question. The iterative design, where the qualitative interview results were used to refine the survey, strengthened the overall approach to gathering information.

All sections are described in more detail below.

Key Informant Interviews with INGO Directors

First, the research employed key informant interviews with INGO directors working in health (n = 12). The interviewees included M&E directors, mHealth technology leaders, and information technology (IT) directors. Within this sample, the majority (n = 9) were those who were using mobile technology fairly extensively; the remaining three were part of organizations whose use of mobile technology was still in the formative stages. The interviews' objective was to understand in more detail how these individuals were or were not adopting mobile technology into their M&E systems; what they viewed as the facilitators and barriers to adoption; and how they believed that adoption of the technology might improve health outcomes for the people they served. A semistructured interview guide (Appendix 1), whose questions aligned with the conceptual framework, guided the interviews.

The key informant interviews with INGOs followed a purposive sampling strategy. INGOs were selected that were known to have used mobile technology extensively; that had documented, on

the Internet, use of mobile technology in three or more countries; and/or that were widely seen as the leaders in the field. A preliminary list of organizations that fit these criteria (Table 2; n = 10) included: Abt Associates, Care, Catholic Relief Services (CRS), FHI 360, International Rescue Committee (IRC), JHPIEGO, Johns Hopkins University Center for Communications Programs (JHUCCP), John Snow International (JSI), Management Sciences for Health (MSH), and Population Services International (PSI). Similar-size INGOs for which the Internet yielded no external documentation on their use of mobile technology were also selected. A preliminary list of organizations meeting those criteria (n = 10) included: Adventist Development and Relief Association, Africare, American Red Cross International Services, BroadReach Healthcare, Cardno Emerging Markets, Chemonics, EngenderHealth, International Relief and Development, Lutheran World Relief, and Plan International.

Table 2—Preliminary List of Organizations for Key Informant Interviews

DOCUMENTED INGO LEADERS IN MULTINATIONAL MOBILE TECHNOLOGY USE	SIMILAR-SIZE INGOs WITH NONDOCUMENTED USE OF MOBILE TECNOLOGY
Abt Associates	Adventist Development and Relief Association
Care	Africare
Catholic Relief Services (CRS)	American Red Cross International Services
FHI 360	BroadReach Healthcare
International Rescue Committee (IRC)	Cardno Emerging Markets
JHPIEGO	Chemonics
Johns Hopkins University Center for Communications Programs	EngenderHealth
JSI	International Relief and Development
MSH	Lutheran World Relief
PSI	Plan International

Key personnel within these organizations working on mobile technology or on M&E were contacted, and the first people to respond were selected for interview. A total of 17 respondents (out of the 20 potential people) were eventually contacted. Contacts for the remaining three organizations could not be sourced. Of the 17 respondents that were contacted, 12 agreed to be interviewed, one refused, three did not respond to the request for an interview, and one agreed but in the end was not interviewed. The publicly available information on the use of mobile technology for M&E of respondents who did not respond or who refused was mixed, with some known as users

and some unknown. Upon interview, some of the organizations identified as not publicly using mobile technology in the original sample were found to be quite advanced (but not public) in their use.

All interviews were recorded, and transcripts were produced. Transcripts were read and corrected, then entered into MaxQDA Version 11. Conventional content analysis, which is generally used with a study design whose aim is to describe the general situation and where research literature is limited,[92] was used to do preliminary coding for the interviews. The conceptual framework categories served as the initial frame for preliminary coding. Results from the preliminary coding exercise were used to refine and focus the survey questionnaire. The qualitative analysis was completed after a secondary coding process was undertaken to refine the first codes and to recognize and add additional codes at the category level that did not fall directly into one of the five DOI subcategories.[93] The secondary coding process resulted in an overall coding structure for the dissertation. The MaxQDA Version 11 software facilitated the process of grouping data into categories and subcategories and generated flow charts of emergent themes and interrelationships.

Online Survey of INGO Staff

An online survey gathered information from people who work for INGOs about their experience of adopting mobile technology into their M&E systems (Appendix 2). Part of this survey asked specific questions around each of the five DOI subcategories. These questions were varied in type and included single-response, categorical-response, and multiple-response questions. To collect further information, an open-ended question followed many of the close-ended questions. Another part of the survey used a previously validated organizational readiness index[94] to assess organizational readiness to implement mobile technology into M&E systems, using a five-point Likert scale. The survey was deployed via Survey Monkey™.

Criteria for inclusion in the sample were that target respondents must be on the staff of US-based INGOs (i.e., with headquarters in the United States and or with 501(c)(3) status tax-exempt status in the United States) implementing health programs internationally. University centers that function like INGOs were included in the sample and in the data for analysis. Respondents who indicated that their institution was a "university" or who named a department in a university as their employer were not included.

Table 3—Interest Generated by the Survey on LinkedIn and Google Group Sites

NAME OF THE GROUP/SITE	LOCATION	"COMMENTS*"	"LIKES"	MEMBERS 25 MAY 2013
Global ICT4D Network	LinkedIn	0	1	878
Global Network for INGO Working in Developing Countries	LinkedIn	0	1	165
ICT4D in Africa (Information and Communications Technology for Development in Africa)	LinkedIn	0	0	1,990
IDEAs (International Development Evaluation Association official group)	LinkedIn	4	1	2,342
M&E for Development Professionals	LinkedIn	17	4	5,835
mHealth	LinkedIn	0	0	4,142
Monitoring and Evaluation Professionals	LinkedIn	26	13	11,890
Project Development and Implementation/Monitoring and Evaluation	LinkedIn	0	3	2,895
ICT4CHW (Information and Communications Technology for Community Health Workers)	Google Group	1	17 (views)	Unknown

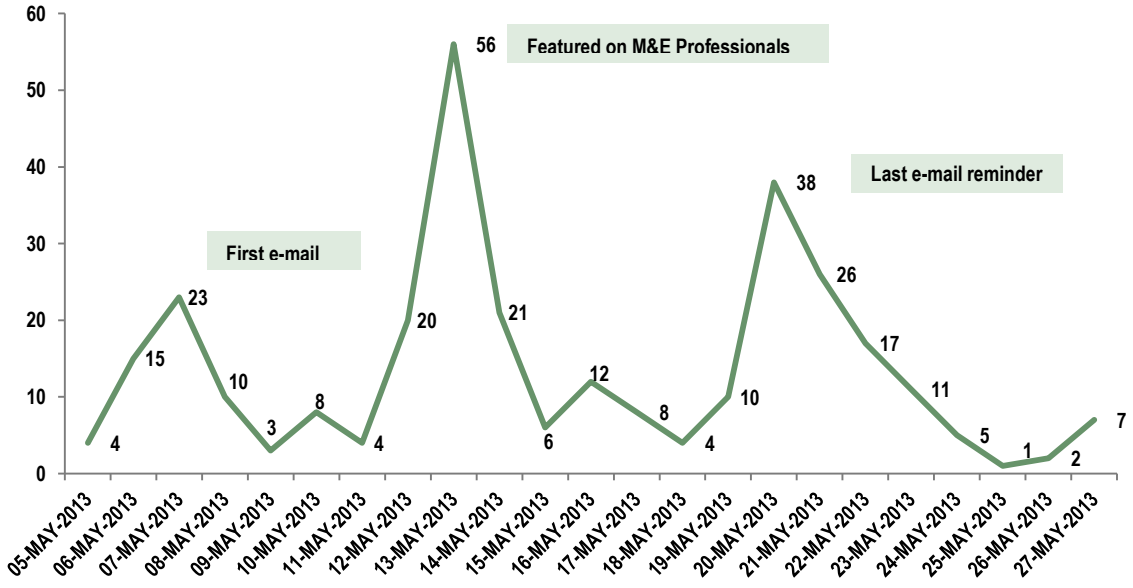
** Does not include comments made by the researcher.*

The survey was advertised and disseminated by direct e-mail to INGO colleagues in the researcher's network, and through postings on M&E and mHealth interest groups on LinkedIn and Google Groups. The LinkedIn Corporation© sites proved to be particularly valuable as a way of advertising the survey to participants outside the researcher's network. Although it also yielded many respondents to the survey who were not in the initial target group, the survey itself generated great interest. Table 3, below, summarizes the groups where the survey was posted and the number of "Likes" and "Comments" the survey generated in each group.

The survey was open from May 5–27, 2013. Survey responses were reviewed daily to understand who the respondents were and to send targeted e-mails to M&E or other directors at INGOs with a low response rate. Among the most effective methods of distributing the survey, especially to encourage multiple respondents per organization, was to identify an organization's

M&E or mHealth director and to ask that individual to distribute the link among colleagues. M&E and mHealth directors within organizations were identified through personal contacts, through key informants, and through LinkedIn. Identifying a key person in the organization and asking him or her to distribute the survey boosted organizations' response rate, so that 12 organizations had at least five respondents and were able to be included in the organizational readiness assessment. Respondents from nonqualifying institutions (e.g., government, local NGOs, unaffiliated consultants, and university respondents not affiliated with centers) were excluded from the final analysis for this dissertation.

Figure 4—Number of INGO Respondents to the Online Survey Each Day



No financial incentives were offered. All participants were offered an advance copy of the findings in exchange for participation. Directors of INGOs were offered a de-identified copy of their organizational data if at least eight staff members responded to the survey. The advance copy of the findings was of interest to participants, and more than half provided e-mail addresses at the end of the survey or contacted the researcher after participating to ask for an advance copy of the results.

Respondents were recruited via direct e-mail, via e-mail from leaders within their organizations, and through a public LinkedIn interest group. While there was response from a diversity of INGOs (n = 67) and from a range of countries (n = 45), of 311 respondents, 22 respondents stopped the survey before the early questions on previous use of mobile technology in the past and intention to use mobile technology in the future (Table 4). A further 51 to 52 respondents stopped responding to the survey after these mobile technology use questions, effectively reducing the overall sample to 237. When nonrespondents were assessed against the required question of role in their organization, there were no notable difference between headquarters or regional office staff and field staff for any variable, and there were no significant differences between M&E professionals and other professionals who answered the survey in terms of nonresponse.

Table 4—Characteristics of Nonrespondents to the Online Survey

	PERCENTAGE WHO HAVE USED MOBILE TECHNOLOGY BEFORE	PERCENTAGE INTENDING TO USE MOBILE TECHNOLOGY IN THE NEXT YEAR	PERCENTAGE WHO HAVE SEEN ORGANIZATIONS LIKE THEIRS USE MOBILE TECHNOLOGY FOR M&E	ALWAYS OR SOMETIMES THE FIRST ONE TO TRY NEW THINGS WITH TECHNOLOGY
Headquarters or regional office staff	7.5	5.8	21.7	20.0
Country or field office staff	6.8	7.9	25.1	25.7
M&E professional	6.6	7.2	24.7	24.7
Other professional	7.6	6.9	22.8	22.1
Totals	7.1 **(n = 22)**	7.1 **(n = 22)**	23.8 **(n = 73)**	23.5 **(n = 74)**

Key Informant Interviews with Platform Providers

Qualitative interviews with key informants from major mobile technology platforms used by INGOs were conducted to obtain perspective and observations from outside the INGO world on use of mobile technology and to understand how these key informants see the facilitators and barriers to INGOs' incorporating mobile data collection platforms into their work. Preliminary results from

the INGO interviews and preliminary analysis from the INGO survey were used to refine the probes asked during the semistructured interview. The same DOI framework for the interview guide was used (Appendix 3). These interviews were recorded, transcribed, and then coded using MaxQDA Version 11 and the same method described above for coding of interviews with INGO directors. Responses to questions provided an external perspective on innovation.

For the key informant interviews with the main mobile data platform providers, a purposive sampling strategy was also used. Directors of platforms documented as being most frequently used among INGOs were selected for interview (Table 5). A total of nine key informant interviews were conducted with platform providers.

Table 5—Major Mobile Technology Data Collection Providers Used by INGOs from Internet Research

PLATFORM	PARTNERS
ChildCount+	UN Agencies
CommCare	World Vision, Partners in Health, PathFinder
DataWinners	PSI, CRS, Pact
EMIT (now known as iCapture)	JHUCCP
Formhub	Development Alternatives, Inc. (DAI), Columbia Earth Institute
Frontline SMS	Plan International, Pact
iFormbuilder	CRS
Magpi (formerly Episurveyor)	JSI, MSH, Abt Associates
Mobenzi Researcher	Oxfam, Pact, US Centers for Disease Control and Prevention (CDC)
Open Data Kit	FHI 360, Red Cross, JSI
TexttoChange	World Wildlife Fund (WWF), JHPIEGO, African Medical and Research Foundation (AMREF)
Viewworld	Care, Danish Red Cross

Survey Data Management and Analysis

For the quantitative analysis, all survey data were collected using Survey Monkey. Data were exported from Survey Monkey to SPSS Version 21 for data analysis. Univariate and bivariate descriptive tables summarizing the findings, using Pearson's chi-squared statistics to determine whether key variables differed significantly from those for the overall population. Difference from the mean was determined to be significant if the value was less than $p = .05$. The main variables of interest were headquarters versus field personnel, M&E versus non-M&E personnel, respondents

who had used mobile technology versus those who hadn't, and those who were planning to use mobile technology versus those who were not planning to use it.

Data were organized around the five DOI organizational readiness subcategories. For each subcategory, questions posed in the survey were cross-tabulated with the main groups of variables to look for trends in the data.

For the organizational readiness for change (ORC) assessment, a subset of data were examined for the 10 organizations that had six or more respondents to the scale questions (Appendix 2, Item 17). For these organizations, the item Cronbach's alpha and intraclass correlation (ICC) from a one-way random effects ANOVA were calculated. These measures were calculated in order to test the reliability and validity of the individual-level data (Table 6).

Table 6—Reliability Testing for Organizational Readiness for Change Data

METRIC	CRONBACH'S ALPHA	ICC (95% CONFIDENCE INTERVAL)
Change commitment	.912	.905 (.875-.929)
Change efficacy	.898	.895 (.864-.920)
Resource availability	.799	.799 (.716-.857)
Task knowledge	.920	.921 (.894-.942)
Change valence	.663	.665(.527-763)

Overall the Cronbach's alpha scores for all metrics were above the acceptable level of .700,[95] except the metric for change valence, which was excluded from the final results presented in Chapter 4. An ICC coefficient for a one-way random analysis of variance was also computed for each of the metrics. For this model, raters are considered as sampled from a larger pool of potential raters, and are treated as random effects; the ICC is then interpreted as the percentage of total variance accounted for by subjects/items variance.[96] Overall, the ICC measurements for all metrics except the change valance were within acceptable levels.

Institutional Review Board Considerations and Confidentiality Issues

Approval from the Institutional Review Board (IRB) of the University of North Carolina at Chapel Hill was obtained for this study. The name of respondents' institutions were collected but are not reported in the research. Names of institutions were required to ensure understanding of the number of respondents per organization, but there is no attribution to organizations.

During qualitative interviews, no identifying information about the respondent or about that individual's organization was collected. No identifying information is included in this dissertation. All respondents answered questions based on their professional knowledge; no sensitive personal questions were asked.

Original study data are available only to the researcher and research assistants listed on the IRB application. Survey data is stored on a password-protected computer. All data in the online survey platform are also password protected. Before the final dataset or subsets of the final dataset are distributed or shared, all identifiers will be removed.

CHAPTER 4
RESULTS

"I think if there's one area where it's easy to do mobile . . . it is in fact M&E."

(INGO Interviewee)

This chapter will summarize INGOs' readiness to adopt mobile technology into their monitoring and evaluation systems for health programming. Specifically, the results will frame the readiness in terms of the five areas identified in the diffusion of innovation literature.

Research Participants

INGO Interviewees

Twelve key informant interviews were conducted with INGO representatives. The interviews ranged from 40 to 60 minutes. Of the 12 interviewees, nine had extensive experience with mobile technology, and three worked for organizations whose use of mobile technology was at a more nascent stage. In the following pages, these respondents will be identified as "INGO interviewees."

Platform Interviewees

Nine key informant interviews with platform providers were conducted. The interviews ranged from 35 to 60 minutes. For one platform, two interviewees responded to questions for the organization on the same call. The sample of platform providers is representative of the companies that are frequently used by INGOs. All the platform providers had worked with INGO clients in the past. In the following pages, these respondents will be identified as "platform interviewees."

Online Survey Respondents

For the online survey, there were 546 respondents (Table 6). Of these, seven did not proceed beyond the informed consent. Among all respondents, 64 did not answer the majority of the questions or did not provide the name of their organization, which either did not provide enough data or did not allow the researcher to know if the respondent was in the research target group. Because public methods (i.e., LinkedIn and listservs) were used to recruit respondents, a further 164 respondents did not actually work for INGOs in health. Rather, they worked for local NGOs, government, agencies of the United Nations, university departments, or private consulting firms. For this analysis, respondents from university centers working in the field like INGOs were included (i.e., the centers at Indiana and Columbia universities), as were for-profit companies that work in the international development space in the same capacity as INGOs (i.e., Chemonics and Development Alternatives, Inc., or DAI). For all respondents who entered "other" and provided their organization's name, an Internet search was conducted to determine whether the respondent was from an INGO (or a university center or a for-profit entity working in the development space) and whether their organization was based in the United States. Where the name of a respondent's organization indicated that it was not an INGO or was not based in the United States for the purposes of this dissertation, the respondent's responses were excluded from the dataset; after these exclusions, 311 respondent surveys formed the basis for the analysis.[ii] In the following pages, these respondents will be identified as "online survey respondents."

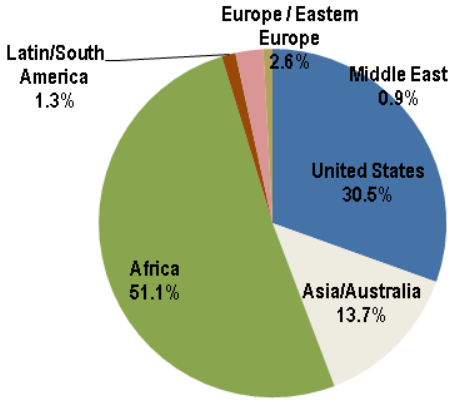
Table 7—Online Survey Respondents Included in the Dataset

CHARACTERISTIC	NUMBER	REMAINING
Total number of respondents	546	546
Number who did not consent	7	539
Number who did not complete the survey or name their organization	64	475
Number who did not work for an INGO	164	311

[ii] It would be interesting to look at the total universe of respondents in a separate analysis to understand how organizations more broadly than INGOs are thinking about the adoption of mobile technology for monitoring and evaluation. However, this question is beyond the scope of this research. Additionally, because many respondents failed to answer many questions, the effective sample size was reduced to 237 for many questions.

Online survey respondents represented 65 different INGOs and respondents from 47 countries. Most respondents (51.1%) were based in Africa, followed by the United States (30.5%) and Asia (13.7%), illustrated in Figure 5. There were few respondents from Europe, the Middle East, Latin America, or South America.

Figure 5—Geographic Base of INGO Online Survey Respondents



Of all online survey respondents, 70.6% had used mobile technology during the last year, 77.2% were intending to use mobile technology in their programs over the next year, and 72.6% had seen organizations like theirs using mobile technology (Table 8). Using a Pearson's chi square test (testing for significance at the p = .05 or less), headquarters staff were statistically significantly more likely to have used (p = .010) and to be planning to use mobile technology (p = .025) than country office or field staff. There was no significant difference between headquarters and field staff with regard to having observed organizations using mobile technology (p = .085). When comparing M&E professionals to non-M&E professional respondents, there were no significant differences in the percentage who had used mobile technology (p = .532); who were planning to use mobile technology (p = .816); or who had observed others using mobile technology (p = .067). Overall, 54.5% of respondents were men and 45.5% women. There was no significant difference between men and women in having used mobile technology (p = .787) or in having observed other organizations using mobile technology (p = .067). However, women were significantly more likely to be planning to use mobile technology during the next year (p = .032).

Finally, most respondents (79.0%) were self-described early adopters of technology, those who believed they were "usually" or "sometimes" among the first to try new technology; only 21.0% of respondents were "rarely" or "never" the first ones to try new things with technology. Early adopters were significantly more likely to have used mobile technology (p = .008), but were no more likely to be planning to use mobile technology (p = .121) or to have observed others using mobile technology (p = .253).

Table 8—Basic Characteristics of Online Survey Respondents

CHARACTERISTIC	PERCENTAGE WHO HAVE USED MOBILE TECHNOLOGY BEFORE	PERCENTAGE INTENDING TO USE MOBILE TECHNOLOGY IN THE NEXT YEAR	PERCENTAGE HAVE SEEN ORGANIZATIONS LIKE THEIRS USE MOBILE TECHNOLOGY FOR M&E
Headquarters or regional office staff	79.3	84.1	78.7
Country or field office staff	65.2	72.7	68.5
	p = .010	**p = .025**	**p = .085**
M&E professional	69.0	76.6	77.6
Other professional	72.4	77.8	67.0
	p = .532	**p = .816**	**p = .067**
Male	70.1	72.4	77.3
Female	71.7	76.9	77.4
	p = .787	**p = .032**	**p = .087**
Always or sometimes the first one to try new things with technology	75.3	80.2	74.9
Not usually or rarely the first person to try new things with technology	56.0	70.0	66.7
	p = .008	**p = .121**	**p = .253**
Totals	70.6 **(n = 289)**	77.2 **(n = 289)**	72.6 **(n = 237)**

The next section of the results will look at each of the diffusion of innovation areas and the findings from each set of data.

Results Relating to Tension for Change

"We saw as a big obstacle to the successful implementation of that survey, the use of paper—gathering all of that information on paper and bringing it back to some central level, where you had to hire data entry personnel to type it in manually. They have to create and maintain a database for all of this data that was coming in."—INGO Interviewee

In the DOI framework, "tension for change" refers to whether members of an organization believe that the existing situation is untenable and that something must change. Related to this dimension is the DOI concept of relative advantage, in which results focus on the level of conviction that an innovation—in this case, mobile technology—will be valuable to the organization. This section of the research considered that as well as task-related issues, such as whether staff at all levels within the organization see and understand how mobile technology might improve data collection capability.

The data collected from all research participants around the tension for change fell into four categories:

- Tension for change stimulated by mobile technology's perceived efficiency, effectiveness, and cost-effectiveness.
- Tension for change around perceptions of mobile technology's ability to refine the precision of measuring health outcomes, improve the ability to measure health outcomes, and raise data quality or enhance the ability to use data for decision making.
- Tension for change around the risk of adopting mobile technology.
- Tension for change around the need for more immediate data for programming.

The findings for each of these key themes will be discussed in more detail below.

Results Relating to Tension for Change

Survey participants were offered no specific definitions of what might constitute efficiency, effectiveness, or cost-effectiveness for mobile technology. In the INGO and platform interviews,

respondents spoke about efficiency relative to the timeliness and quality of data that can be collected with mobile technology. They spoke about effectiveness as a way of ensuring that INGO M&E systems could deliver data that represented program outcomes. They spoke about cost-effectiveness of mobile technology relative to traditional paper-based forms.

Results from INGO Interviewees on Mobile Technology's Efficiency, Effectiveness, and Cost-Effectiveness: Overall, INGO interviewees felt an increasing need in their community for cleaner, timelier data. INGO key informants discussed the need for lower costs and the greater reliability of hosted, remotely stored, or cloud-stored data. Although the evidence on cost is not yet clear—because the set-up costs for mobile technology systems can seem prohibitive—INGO key informants who are leading the introduction of mobile technology hoped that "if you can entice people [in the INGO community] to try it out, and if [they] are brave enough to try it out," mobile technology's efficiency would quickly become apparent.

Many INGO key informants noted that mobile technology significantly reduced time required for data entry and cleaning, permitting quicker analysis. One respondent discussed the utility of mobile technology:

> *"Mobile phones are just computers—they're just smaller computers. And when we apply them appropriately, they capture and report the data that leads to the best public health intervention." (INGO Interviewee)*

Another interview respondent felt more research was needed on cost-effectiveness:

> *"More studies around the effectiveness, and particularly the cost-effectiveness, are really needed to really influence donors, because really donors drive a lot of the programs and what's done in programs." (INGO Interviewee)*

In this era of constrained resources and with little hard evidence on cost-effectiveness, the decision to invest in mobile technology can be difficult. According to one INGO interview respondent:

> *"A lot of big NGOs have huge financial issues right now, so they're trying to prioritize what they have to do. And when we were talking about really moving forward with mobile technology and trying to implement it on a grander scale and mainstreaming [it] into all our*

health programs, I was told, 'Use of mobile is something that we would like to do, but not something we have to do.'" (INGO Interviewee)

Results from Platform Interviewees on Mobile Technology's Efficiency, Effectiveness, and Cost-Effectiveness: Platform providers concurred that a major factor driving the adoption of mobile technology was its perceived efficiency, effectiveness, and even cost-effectiveness. Most platform providers have their first interaction with INGOs when the organization is experiencing what many providers called a "pain point." These pain points often occur around the need for accurate and timely availability of data for reporting to a donor, and reporting is often the point of departure for the use of mobile technology. Having more near-real-time data is a persuasive selling point for INGOs.

"I think it allows an organization a better opportunity to use its resources effectively to collect meaningful data, and to do it in a real time or at least a . . . rapid fashion. I would be hesitant to say that it has improved things, but I think it's got a great potential to improve things, if understood and used correctly, the applied correctly." (Platform Interviewee)

Platform providers felt that mobile technology would make INGO systems more cost-effective, because they do not see the systems as costly. They felt the trade-offs for efficiency gained would outweigh the actual systems costs.

But a number of platform providers also talked about improved efficiency having a down side in that it might reveal things about the organization or the project that are sufficiently obscured by the existing system. One provider said:

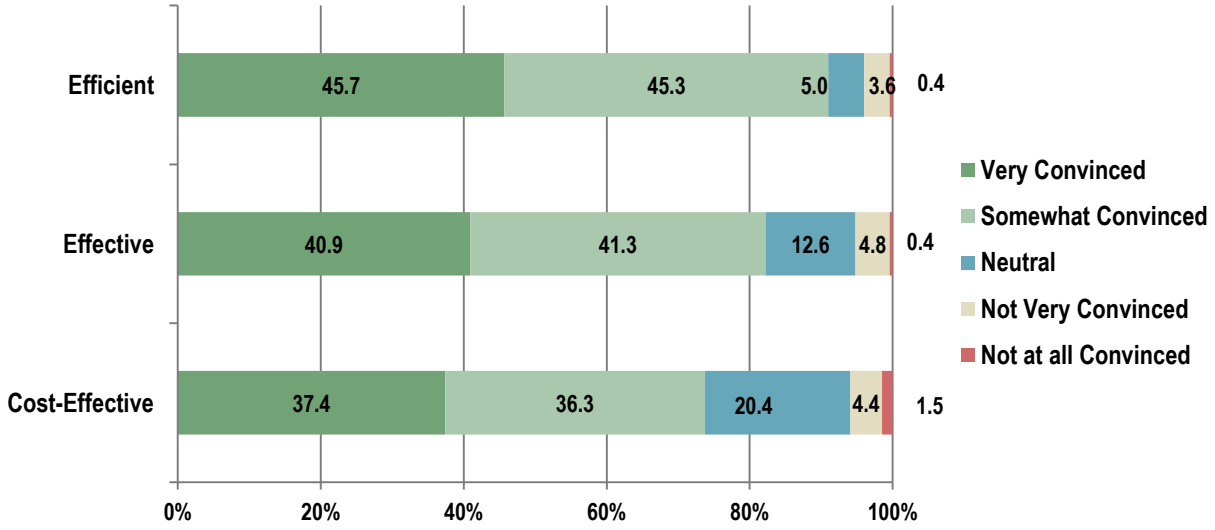
"I get the sense that there are people out there that are getting their feet wet, but the jump between that and actually having . . . managed organizational change to the point where you're collecting data from a mobile source that you feel confident enough to share what somebody outside your organization, is still in the early stage." (Platform Interviewee)

Full trust in mobile technology for M&E systems in health programs was not yet observed by platform providers.

Results from Online Survey Respondents on Mobile Technology's Efficiency, Effectiveness, and Cost-Effectiveness: The online survey revealed high levels of conviction that mobile technology would

make systems more efficient, more effective, and even more cost-effective. Online survey respondents were most sure of systems' efficiency and effectiveness and least certain about mobile technology's ability to improve systems' cost-effectiveness. A total of 45.7% were very convinced, and 45.3% somewhat convinced, that mobile technology would make M&E systems more efficient (Figure 6). A total of 40.9% were very convinced and 41.3% were somewhat convinced that mobile technology for M&E systems would make their systems more effective. Finally, 37.4% were very convinced and 36.3% were somewhat convinced that mobile technology for M&E systems would make their systems more cost-effective. The percentage of the online survey respondents who were not very convinced or not at all convinced ranged between 4.0% and 5.9%.

Figure 6—Conviction about the Utility of Mobile Technology (Percentages)



Results Relating to Data Quality

Results from INGO Interviewees on Data Quality, Precision, and Use, and Health Outcomes: INGO interviewees were impressed with how mobile technology could improve the quality of data in M&E systems. The availability of systems that collect information in a systematic way, with skip logic to avoid entry errors and drop-down menus to improve ability to aggregate, were all seen as positive features that improve the quality of collected data. One interviewee said:

"If the respondent doesn't give [the enumerator] an answer that's clear from their options[the enumerators will] sort of just mark in the margins. No matter how hard we try, a lot of times, they don't follow the choices on the [paper] survey if they get gray areas from respondents. Mobile technology or any kind of automated technology forces them to make a choice. And we usually give them a note section to make their notes." (INGO Interviewee)

Although many INGO interviewees agreed that there is a demand for data for decision making, they also acknowledged that feedback loops on how to use the data are not always fully formed:

"[The] Uganda [office] was gathering data that they were able to use in real time for decision making, but it also presented a problem: They had to train health staff to use the data." (INGO Interviewee)

One INGO interviewee said this in a different way:

"For all the work to deploy a mobile solution, the end result should be getting to make better decisions with better data in more real time." (INGO Interviewee)

Mobile technology was seen as a seamless way to automate some analysis and feed it back to data providers. Creating basic charts and graphs of the data, commonly known as dashboards, is built into platforms' functionalities, and these dashboards make it fast and efficient to get data back to people.

As a concrete example of how data for decision making is being used, INGO interview respondents reported that mobile technology much improved data collection in the field, enabling data collectors to receive real-time feedback on their performance and giving project managers—who once had to wait for baseline and endline surveys to understand performance—immediate access to data to inform day-to-day supervision. One respondent said:

"The best interventions, the best public health approaches, are driven by facts on the ground, the actual findings revealed by the data. And mobile facilitates that. It's just a tool. It can be implemented poorly. It can be done in such a way that it has no impact. But in the realm, especially, of monitoring and evaluation, in the realm of data gathering and data reporting, there's no question that it can, does, and will work." (INGO Interviewee)

INGO interviewees reported mixed results on whether mobile technology for M&E systems would actually serve to improve health outcomes for beneficiaries. Most reported that by improving near-real-

time data availability for decision making, it had the potential to do this, but that it had not been seen as a fully operational system.

Results from Platform Interviewees on Data Quality, Precision, and Use, and Health Outcomes: Platform providers had observed that the data quality and use of data for decision making were improved by INGOs (no responses mentioned the precision of data specifically). One of the drivers of data quality was more rigorous advance thinking about data structure for mobile technology and about that data's connection to other sets of data in the organization. One respondent said:

> *"So you're trying to put a structured system or a structured approach on top of what sometimes, on the ground, is a rather fluid or unstructured process. And obviously, there are advantages to doing that. You are getting very, very high quality data, because you have to follow the sequence of questions, whatever the case is. But the organization has to do a lot of soul-searching and a lot of thinking about how the process actually works on the ground." (Platform Interviewee)*

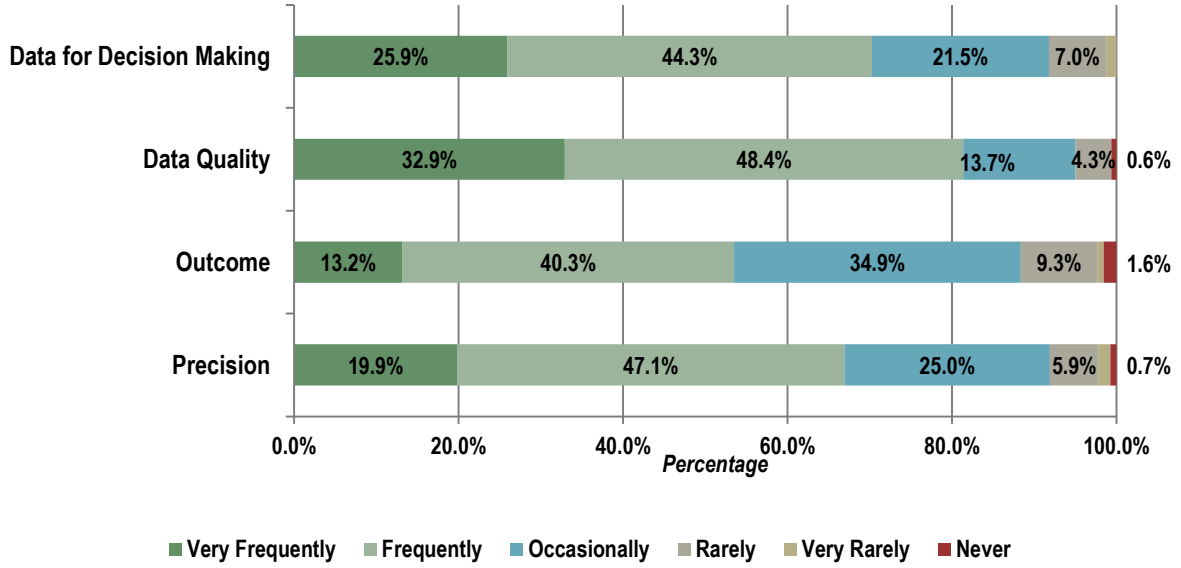
Platform providers were generally on the fence about whether mobile technology could help improve health outcomes for beneficiaries. Although providers reported improvements in data timeliness and in the quality of data that could aid in decision making, whether that would translate to improved health outcomes was a leap. According to one platform manager:

> *"The technology can do its job 100% perfectly and you can still have very poor M&E or very poor data collection. So the technology is definitely not going to be a silver bullet. Still, it allows an organization a better opportunity to use its resources effectively to collect meaningful data, and to do it in a real time or at least in a very rapid fashion. I would be hesitant in saying that it has improved things, but it's got a great potential, if understood, used correctly, and applied correctly." (Platform Interviewee)*

Results from Online Survey Respondents on Data Quality, Precision, and Use, and Health Outcomes: All online survey respondents were asked specifically how frequently mobile technology had led to better use of data for decision making and improved data quality and had contributed to improved health outcomes for beneficiaries and improved precision in health measurements. Online survey respondents' answers ranged from "very frequently" to "never" (Figure 7). The results show that improvements in data quality were the most frequent experience that mobile technology supported,

with 81.3% reporting that mobile technology improved data quality "frequently" or "very frequently." In addition, 70.2% said that mobile technology led to better use of data for decision making "frequently" or "very frequently." Nearly as many (67.0%) reported that use of mobile technology would improve the precision of their data "frequently" or "very frequently." . Even more than half of research participants (53.5%) thought mobile technology would improve health outcomes for program beneficiaries "frequently" or "very frequently."

Figure 7—Precision, Health Outcomes, Data Quality, and Decision Making



Results Relating to Immediate Needs for Data

Results from INGO Interviewees on Immediate Needs for Data: Data timeliness, especially data availability in near-real time, was a major benefit of mobile technology for INGO respondents. The need for timelier data normally emanates from a reporting need, as previously noted. But after organizations begin to experience faster data, they want more of it, they said.

One INGO interviewee also mentioned another potential benefit in efficiency.

"Some side benefits are not well measured yet. . . . When we had field agents use laptops, their status went up in the community. Our field agents were very proud to have those new

life skills, and it made them more valuable to the community. I get the same impression in the health area, where we've used mobile phones with community health workers not only to collect data on, you know, mortality statistics or pregnant women and infants and newborns, but also to do coaching of women on good pregnancy practices. We know that people really appreciate the technology. They understand the efficiency it provides them. They don't have to travel to return the reports, you know, but they're very excited, and I think they feel that they have information at their fingertips, information they can use. And you can see that the community seems to respond to them more, too."" (INGO Interviewee)

The same respondent also said:

"If you're collecting data on paper, you have to key it in and you have more data cleaning to do. That's more labor, so it reduces the labor that can be applied to other things. . . . When I visited clinics in India, the women were telling me that if they had electronic systems and weren't dealing with . . . paper registers, they would have time to see more people in their clinics. And if you can see more people, you can reach more people." (INGO Interviewee)

INGO respondents reported efficiencies not only for their M&E staff in data reporting, but also for program staff: Spending less time on data collection, transport, and analysis, could equate with more time spent working directly with clients.

Results from Platform Interviewees on Immediate Needs for Data: For platform providers, immediate need for data was a major driver for the adoption of mobile technology and one of the things that excited their INGO clients about the use of mobile technology for M&E systems.

"What they want is to shorten the amount of time between collecting the data and being able to make their decisions. They're dissatisfied with the performance [of their paper-based systems] or with the time it takes between collecting the data and having the information available for operational decisions." (Platform Interviewee)

Platform providers, like INGO respondents, talked often about the ubiquity of mobile technology and their interest in harnessing the power of mobile technology to access near-real-time information for decision making.

Results from Online Survey Respondents on Immediate Needs for Data: Overall, 55.9% of research participants said that at the time of completing the survey they had a specific project or data collection need for which mobile technology was not being used, even though it might be the best

technique (Table 9). There were no significant differences in the responses between M&E professionals and other professionals.

Table 9—Percentage Reporting an Immediate Need for and Use of Mobile Technologies

RESPONDENT	IMMEDIATE NEED	NO IMMEDIATE NEED	DON'T KNOW
Headquarters or regional office staff	58.9	9.5	31.6
Country or field office staff	53.9	22.7	23.4
			p = .025
Always or sometimes the first one to try new things with technology	58.4	20.2	21.4
Not usually or rarely the first person to try new things with technology	50.0	9.1	40.9
			p = .017
Had previously used mobile technology	54.9	21.7	23.4
Had not previously used mobile technology	59.3	5.1	35.6
			p = .008
Planning to use mobile technology to collect data in the next year	58.1	18.7	23.2
Not sure or not planning to use mobile technology to collect data in the next year	45.9	8.1	45.9
			p = .012
Totals	55.9	17.4	26.7

However, where the respondent was based did affect response, with field staff significantly more likely to report they had an immediate need when compared with headquarters staff (p = .025). Similarly, early adopters were also more certain of their need (and were more likely to have an immediate need; p = .017). A respondent who had previously used mobile technology was more likely to recognize a need (p = .008); those planning to use mobile technology during the next year were also more likely to be decided on their need than those who weren't sure if they'd be using it (p = .012). Overall, higher levels of indecision about whether there was an immediate use for mobile technology were found among headquarters staff, late adopters, those who had not previously used mobile technology, and those who were not planning to use it during the next year or were not sure of their plans.

In open-ended responses, 87 online survey respondents further detailed their main areas of immediate need for mobile technology. These included routine reporting systems from health facilities; surveys and M&E systems; referral projects; and nutrition and growth monitoring projects.

Respondents called these the key areas in which mobile technology would be an added value to program implementation.

Results Relating to the Perceived Risk of Adopting Mobile Technology

Results from INGO Interviewees on Risks Perceived for Adopting Mobile Technology. INGO interviewees talked about the risk of adopting mobile technology. The main concern was that its introduction be seamless so that people could see how it can work for them. A bad initial experience, they said, could negatively affect their willingness to use mobile technology going forward.

Other concerns were with creating silos of information or setting up systems that would not talk to one another, systems that would not easily share information but would leave it trapped in its own vertical channel, unlinked to other data flows.

> *"Sometimes there are risks if the approach is not coming from an overarching goal and if [approaches] are uncoordinated. . . . So, either people could be using different software and might not be able to kind of meet up or talk to one another—or they could all feed into one global system. There is definitely the risk of having siloed approaches, that aren't integrated." (INGO Interviewee)*

Results from Platform Interviewees on Risks Perceived for Adopting Mobile Technology: Platform providers perceived risk as linked closely with resistance to organizational change. They observed that a major obstacle to the adoption of mobile technology was the risk involved in changing as an organization or as an individual with a specific job description. In reference to trying mobile technology, one provider noted:

> *"Nobody ever gets fired for doing things the same way as they've always been done, right? There's a huge incentive to be conservative. There's a reason why we call it 'going out on a limb.' If somebody wants to do things differently, they . . . put themselves in a position where they can be attacked." (Platform Interviewee)*

This resistance to change, the perception of the risk inherent in trying something new, was seen at an organizational level by the providers who routinely engage with INGO clients. As mentioned

above, the other risk is that a spotlight might be put where it was not earlier, without positive consequences:

> *"In international development we are accustomed to not having data. We are accustomed to not evaluating. We are accustomed to not monitoring. That is okay. It's okay to have programs —even programs where 10% of the budget was supposed to go to M&E—where nothing got evaluated. That's acceptable." (Platform Interviewee)*

Results from Online Survey Respondents on Risks Perceived for Adopting Mobile Technology:

In the online survey, 20.3% of respondents were undecided about whether adopting mobile technology for M&E systems entailed risk. Of remaining respondents (Table 10), headquarters staff had significantly different opinions about the level of risk than field staff (p = .007), with the largest difference between country-level staff (reporting no risk 21.8% of the time) and headquarters staff (reporting no risk 5.3% of the time). Conversely, headquarters staff were much more likely to report medium risk (41.3%) as opposed to country or field office staff (26.4%). There were no significant differences by type of respondent (M&E professional or other professional, by previous or future mobile technology use).

Table 10—Perception of Risk Level of Incorporating Mobile Technology into Systems (Percentage)

LOCATION AND POSITION	HIGH	MEDIUM	LOW	NONE
Headquarters or regional office staff	2.7	41.3	50.7	5.3
Country or field office staff	5.5	26.4	46.4	21.8
				p = .007
Total (n = 185)	3.4	25.9	38.4	12.1

In the area for open-ended responses, where respondents were asked about the risks the organization might face if mobile technology were implemented, the survey yielded 48 written responses from country office staff. Their concerns lay with—"data cooking" (i.e., data falsification)—and the lack of a paper trail that could be used to audit data quality. They were also concerned with the risk of implementing a system in environments characterized by low connectivity and low power supply. If a system were implemented, they worried, it might not work, and the situation would then be expensive to rectify. They also worried about resistance from staff who might not properly understand the system. Cost was another risk mentioned by country-level staff, including the cost of buying and

replacing phones as well as possible abuse of phones and the cost of training everyone to use the technology. There was also concern over whether, if the investments were made, they would result in sufficient added value. Possible data loss or inability to retrieve data from devices was also reported as a possible risk.

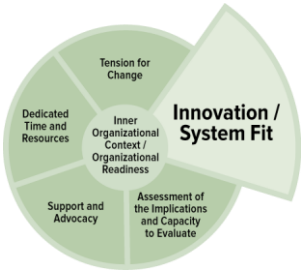
Headquarters personnel, who provided 24 written responses to the open-ended question relating to risk, expressed many of the fears articulated by country office staff, but focused more on risks associated with cost and patient confidentiality, the risk involved in working with ministries of health, and the risk of investing in a system that could become obsolete. There was also concern from US-based personnel about the time it would take to set up systems and with interoperability across country programs.

Summary: Tension for Change

All research participants reported a need for timelier, better quality data in INGO programs in health and expressed the belief that mobile technology could support this need. Online survey respondents were generally "convinced" or "very convinced" that mobile technology would make their M&E systems more efficient and more effective, and slightly fewer (but still a majority) were convinced that it would also make their M&E systems more cost-effective than their current systems. Similarly, online survey respondents reported that mobile technology "frequently" or "very frequently" improved the precision of their data, data quality, and the use of data for decision making within their organizations. There was an overall lack of consensus on whether mobile technology for M&E could improve health outcomes for their beneficiaries. Most online survey respondents (55.9%) had a current project or data collection need for which mobile technology was not being used despite that it might be the best answer. Significant numbers of online survey respondents who had an immediate use or need for mobile technology either had not used mobile technology, were not planning to use mobile technology, or were unsure as to whether their organization was planning to use it. In terms of the risk

of adopting mobile technology for M&E systems, although most respondents felt it was low or moderate, there was more concern about risk among headquarters staff than among country office staff.

Results Relating to Innovation–System Fit



The innovation–system fit dimension of the DOI framework refers to the question of whether an innovation fits with existing organizational systems and makes them easier to use and more efficient. The results presented here will examine the DOI concepts of compatibility and complexity and whether mobile technology use for M&E fits with existing organizational systems or whether aspects of the system will have to be overhauled. Additionally, this section will explore mobile technology's ease of use, look at features and training for various platforms, and examine whether support options suffice for user needs.

Three main themes emerged from the data for innovation–system fit:

- Working with platforms.
- INGO M&E systems, compatibility and interoperability, and data security.
- Where mobile technology fits in INGO programs.

The results for each of these themes are presented below.

Results Relating to Working with Platforms

Results from INGO Interviewees on Working with Platforms: Organizations that have been successful incorporating mobile technology have discovered platforms that were configurable by the end user with little support from information technology staff.

> *"We looked for solutions that worked, that were what I'd call user configurable—you know, the things that a user could easily configure without a lot of IT support—because we knew we could never keep up with the amount of IT support that would be demanded otherwise." (INGO Interviewee)*

INGO interviewees were looking to leverage existing platforms, both platforms from mobile technology providers and database systems that would help them manage and visualize their data with minimal input. Two different respondents said:

> *"I'm part of a team that is developing an information system that's going to help us both better monitor our programs and offer a project management tool. This is a cloud-based system that's going to be built on the Salesforce.com platform. . . . I've seen [this used by] a lot of applications that were not traditional sales, and it has been expanding very, very rapidly. So, leveraging some of the power of that platform, we're using it to meet our needs as a nonprofit." (INGO Interviewee)*

> *"We looked for applications that worked in semiconnected environments. We actually started there. That was the first thing we realized—that we had to have something that would work in a semiconnected environment or one that was only occasionally connected." (INGO Interviewee)*

That one INGO is moving toward cloud-based systems and another is focusing attention on work in semiconnected environments shows that the innovation–system fit for INGOs can vary widely.

INGO interview respondents were divided on whether to work with a single platform partner for their mobile technology needs or to allow diversity of approach. Organizations with longer, more extensive history of mobile technology use are beginning to settle on a defined group of providers. These INGOs will work alongside the selected platform providers to determine the best solutions for their organizations.

> *"Our [time to focus in on] standard platforms has come. I didn't think it would happen for a while, and I didn't think the technology was there. But it's become evident that we needed a smaller set of technologies in order to achieve scale and that we were not going to achieve scale it if we let every flower bloom and every project pick a different partner and a different technology." (INGO Interviewee)*

Another INGO interviewee noted, conversely, being unready to settle on a single provider.

> *"I don't think we will ever be in a situation where one tool will be the end-all tool. Still, we're well beyond the 'Let's experiment and see what works well' phase. We know enough about the tools that exist and how they've been used and when they work and they don't work." (INGO Interviewee)*

A number of INGO interviewees mentioned partnership with platform providers as a key component of their mobile technology work. INGO interviewees reported that unlike big business and big technology companies, mobile technology platform providers working with INGOs have been very responsive to INGO needs and see INGOs as integral to the development and improvement of their platforms. INGO key informants used the words "responsive" and "engaged" to describe their technology partners. INGO key informants recognized that technology development was not their core strength and wanted to leverage the know-how that is out there to benefit their programs.

> *"We are in the business of increasing resiliency and responding to disasters. We're not a technology company. And so what we need [is] to make sure we are not reinventing the wheel. Let's leverage both the advancements in the private sector and those private sector actors' willingness to support our efforts and to respond to our needs." (INGO Interviewee)*

Most INGO interviewees spoke about struggling with how to quickly and effectively communicate platforms' potential and functions to their staff—trying multiple strategies from e-mail to presentations to Webinars to conferences. But they noted that the challenge to bring everyone to the same level of understanding has been immense.

> *"Because not everyone is on the same page, every training needs to be developed to accommodate both those who have an advanced understanding of how things are working and those who need to start from square one." (INGO Interviewee)*

Results from Platform Interviewees on Working with Platforms: For the most part, platform providers find that they must work closely with their clients to help them to convert their traditional paper-based M&E systems to systems based on mobile technology. Indeed, to help INGO clients to make the switch to mobile, most platform providers offer consulting (sometimes included in their services, sometimes available at extra cost). Platform providers stay focused on the technology rather than content but do help INGOs make their systems more rational and more rigorous. One provider summarized a common process:

> *"We meet with the organization, and then they kind of describe what they want to do, and [we say] here's how one of the ways you could do that, and then do some back and forth . . .*

so we can kind of advise based upon our experience working with lots of other organizations." (Platform Interviewee)

Some INGOs appear to be taking what one platform provider described as a "petri dish approach," experimenting with different platforms to discover what they need. Indeed, even organizations that were thinking about scaled operations had previously taken this approach and began to narrow their choices only after they were satisfied with their tests and pilots.

Results from Online Survey Respondents on Working with Platforms: The three platforms most widely tried by online survey respondents were FrontlineSMS, Magpi, and CommCare/DiMagi *(*Table B, Appendix 4). There is a great deal of experimentation with platforms, with very few online survey respondents reporting trying a single platform. Only 18.0% of respondents had ever tried only a single platform; 29.2% had tried at least two platforms, 20.2% had tried three, and 32.6% had tried four or more.[iii]

A total of 33.2% of online survey respondents reported they "did not know" whether platforms had sufficient features to meet their M&E system needs. Of those who reported "yes" or "no," 63.2% viewed the features and functions as sufficient to meet the needs of their M&E system (Table 11). The only significant difference found was between M&E professionals and other professionals. M&E professionals were significantly less likely than other professionals to perceive features and functions as sufficient for M&E systems (p = .020).

Table 11—Features of Platforms

LOCATION AND POSITION	CURRENT PLATFORMS HAVE SUFFICIENT FUNCTIONS AND FEATURES (%)	
	YES	**NO**
M&E professional staff	55.6	44.4
Non-M&E professional staff	73.8	26.2
		p = .020
Total (n = 155)	63.2	36.8

[iii] The survey did not collect information on the number of platforms that respondents were currently using, only those they had tried in the past.

A total of 38.2% of online survey respondents reported they "did not know" whether platforms has sufficient training materials to meet their needs. Of those who reported "yes" or "no," 50.7% felt the training materials offered by the platforms were sufficient (Table 12). Those who were planning to use mobile technology over the next year were significantly less likely to observe that the platform training materials were sufficient (p = .023).

Table 12—Training Materials Available from Platforms

LOCATION AND POSITION	CURRENT PLATFORMS MAKE AVAILABLE SUFFICIENT TRAINING MATERIALS (%)	
	YES	**NO**
Planning to use mobile technology to collect data in the next year	53.8	46.2
Not planning to use mobile technology to collect data in the next year	18.2	81.8
		p = .023
Total (n = 143)	50.7	49.3

Results Relating to Compatibility and Interoperability

Results from INGO Interviewees on Compatibility and Interoperability: Several respondents stated that mobile technology cannot stand alone and needs to be part of a system.

> *"The technology is there. It can be made to work. Databases can be made to speak to one another. But what's most important when implementing a system is the proper design, the proper business analysis, fitting in with the standard operating procedures in the countries, so that the system becomes useful rather than a 'glommed-on' kind of outside intervention." (INGO Interviewee)*

Success with mobile technology was driven not necessarily by the technology, but instead by a strong system that structures the use of more available data in a better way. When that system is in place, the increased speed with which data are available makes it useful.

> *"The technology and the process . . . have to go hand in hand. You can't standardize your systems unless you standardize your process. So if you don't evolve a standard process, then a standard system won't work." (INGO Interviewee)*

One respondent observed that there were "not too many great examples of where we're completely harnessing that potential and really putting it to full use." Many respondents concurred that the process of mobile technology adoption into M&E systems was ongoing.

Most successful organizations have developed or used a structure onto which mobile technology has been grafted as a tool rather than as end in itself. For example, two INGOs began by fully building out their design, monitoring, and evaluation process—and then decided how to apply mobile technology to the system. Others are approaching mobile technology project by project or case by case and still seem to be moving forward, but projects with more centralized M&E systems fed by mobile technology into are moving more quickly toward system wide adoption.

Several INGO interviewees talked about having strong M&E systems and the need to put systems in place before moving forward with mobile technology—not only a strong M&E system, but also a knowledge management system that would allow the entire organization to learn from other parts of the organization. Although most knowledge management platforms are internal to INGOs, there is also a great deal of external collaboration within the mHealth community. Information sharing on the uses and successes of mobile technology has played a major role in speeding adoption of the technology in several organizations.

There was keen interest among INGO interviewees in looking at data at a macro level and synthesizing data on the approach to a problem rather than having only a project-by-project view. These INGO representatives see the importance of having higher-level data that different parts of the organization can examine in order to answer their own questions.

> *"You have a very powerful database to slice and dice that information in . . . whatever way. So . . . a donor takes some of that information, not all of it, and wants to see it in a certain way. An executive director wants to see that same information, but [at] an aggregate level. You may have some communications people who also want to see that information, but they want it presented more graphically. And then you have the M&E experts that we have here at headquarters, who support our programming, and they want to see it at a very disaggregated level. It's all the same information, right, but it's in a system we're able to slice and dice." (INGO Interviewee)*

There was also interest in being able to provide field people with better access to both their own data and that of the global organization so they can understand how they fit into the system.

"So, eventually, from their mobile phones, they're going to be able to see the mechanisms that are happening at the headquarters level. And this is very much in the planning stages right now." (INGO Interviewee)

Among interview participants, the ubiquity of cell phones in the world was seen as a driver of change. In the words of one interviewee, "A lot of people, even the poorest of the poor, have access to mobile phones." Related to the idea of having a cell phone, though, was also the idea of using it for data collection and reporting and how this could lead to a feeling of engagement.

"So that [the survey form or facilitator's guide] is available on a mobile device, the more likely people are to be able to understand what's happening, even be part of the process, and feel more engaged—because the more engaged an employee is, the more engaged a beneficiary is, and the more likely you're going to be to get real results and better information from them." (INGO Interviewee)

Many INGO interview respondents already have defined monitoring and evaluation processes for designing, planning, and implementing programs. These INGOs are using mobile technology to complement an existing process for design, monitoring, and evaluation and building it in alongside the overall program design. Conversely, in one case, mobile technology was driving the creation of a much more defined M&E process in an organization, because the use of mobile technology demands more rigor, definition, and structure than a system based on paper. INGO interviewees also reported using organizational standards to drive experimentation with and introduction of mobile technology at field level by requiring it among projects or country offices.

Other INGO interviewees were using mobile technology just to obtain monitoring data on their activities, such as number of people trained or the number of beneficiaries reached.

"It's really not so—even so much the E [evaluation]. It's just the M [monitoring]. . . . The mobile projects have made the bigger difference in monitoring data, and not so much [in] evaluation data. The evaluation data is when the phones are really being used for surveys, but we've really been focusing more on using it for monitoring data." (INGO Interviewee)

INGO interviewees reported that smartphone apps (or forms) are very intuitive—easy for people to master in a short period. Keen interest was expressed by field staff and partners in using mobile

technology. Comments to this effect tied in closely with ideas of the ubiquity of mobile phones and beliefs that it is INGOs' job to conceptualize and actualize how to better utilize them for data collection and reporting and then to use that data for making decisions. Platforms available today permit data export into a .cvs format (the most common of which is Microsoft Excel) that can be used for any analysis.

Within INGOs, there are competing priorities beyond the introduction of mobile technology. Where basic systems for M&E and a central understanding of M&E standards do not exist, building systems and improving organizational understanding around M&E are a priority over introducing mobile technology. In organizations that had relatively well defined M&E systems, adding mobile technology to speed the inflow of data was an obvious next step. But for organizations with basic systems that still need attention, whether to follow this direction was less clear. One INGO respondent noted that the leap to mobile technology was a big step for organizations working with or through in-country partners performing at the basic level.

As of early 2013, interoperability and data security were hot topics in the field of mobile technology. Several working group meetings were devoted to these subjects, and international organizations (at the level of the United Nations) were trying to establish guidelines that people could use to steer best practices. Interoperability was not seen by INGO interviewees as that much of a problem as long as data could be exported into Microsoft Excel formats.

Results from Platform Interviewees on Compatibility and Interoperability: At least one platform provider echoed that INGO interviewees struggling to move from a system based on paper to one based on mobile technology sometimes had difficulty thinking through what they really needed to collect (versus the "collect everything" or "open response" models). It is often difficult for INGOs to make the shift from paper-based forms, whose design does not demand particular rigor, to mobile forms, which are more effective if responses have been selected during systems' planning stages.

Platform providers have recognized that INGOs' M&E systems are not so complicated that incorporating mobile technology requires a great deal of work. Essentially, they understand that mobile technology platforms can enhance existing methods of collecting data and tracking program achievements.

> *"They [INGO M&E systems] aren't sort of these back-end systems that require serious integration. Most of what we've seen is that organizations have a set of indicators . . . . They don't need to be represented in a particularly fancy way. But [the challenge is] how do you go from transactional raw data, so that these [aggregated] indicators make sense to each of the people that are going to be using them." (Platform Interviewee)*

While compatibility with INGO systems seems to be a high priority for platform providers, there were more mixed sentiments on interoperability. Some platform providers do not see an issue, because they believe that data can be taken from their system at any time and moved to another system. But at least one provider recognized that a form created in the system of one platform provider could be difficult to move to another system.

> *"I have been aware of some INGOs who had started with one tool and then switched eventually, and it required a lot of effort to figure out how to develop some sort of system to put things into the same format, or it required kind of starting from scratch, so you can carry over all of the forms you've designed, or you could carry over. No, if you have an ongoing database and then you switch collection tools, that could mean you have to kind of start over." (Platform Interviewee)*

A bigger issue to platform providers in terms of interoperability was the problem of "data islands." With each INGO creating a proprietary system, with different data definitions and formats for data collection, platform providers feared future problems with aggregation, given the increasing interest in mining all collected data. If data are stored in separate systems and collected with different data definitions and with different methods, they will not be interoperable. A little forethought and standardization would yield much greater flexibility.

> *"This issue of interoperability is a big, big deal. You can head off potential problems by making a commitment to making it easy to extract data from your system, so that two machines can talk to each other. The other really big issue that really hasn't yet been solved is making sure that between organizations you can compare data in an apples-to-apples*

way. Part of the requirement for that is that you start with the same data definitions, the same questions, the same criteria for answers." (Platform Interviewee)

From the perspective of platform providers, the issue of data security has been thornier. The main challenge identified was that many developing country governments are not comfortable with cloud-hosting of data on their citizens and would like their data hosted on servers within their national borders (and subject to their control). Although many platform providers who are using mobile technology would argue that the data are actually less secure when managed on servers in a developing country setting (subject to power failures and weak back-up protocols), a major issue has been the location of data storage, especially when the data are sensitive. Some platforms, especially those designed for health research, automatically remove the data from the phone as soon as a data connection is available—thus not permitting completed data to remain on that mobile device. Several platform providers also mentioned that host-country governments were unlikely to be able to provide server back-up and maintenance equivalent to that provided by specialized, cloud-based servers.

Results from Online Survey Respondents on Compatibility and Interoperability: Overall, 24.1% of online survey respondents reported they "did not know" whether mobile technology was compatible with their M&E systems. Of those who reported it was "compatible" or "not compatible," 77.8% affirmed that mobile technology was compatible. There were no significant differences by type of respondent in the dataset.

A small percentage of online survey respondents (11.4%) reported they "did not know" whether they had observed other organizations like theirs using mobile technology for M&E systems. Among the rest of the respondents, 81.9% had observed organizations such as their own using mobile technology (Table 13). Differences were significant between headquarters staff, who were more likely to have observed others using mobile technology than country office staff ($p = .027$). Differences were also significant between those who were planning to use mobile technology over the next year, who were

more likely to have observed other organizations using mobile technology for M&E (86.2%) than those who were not planning to use mobile technology, who had observed others using mobile technology only 64.3% of the time (p = .001).

Table 13—Observations of Use of Mobile Technology in M&E Systems

LOCATION AND POSITION	HAS OBSERVED COLLEAGUE ORGANIZATIONS USING MOBILE TECHNOLOGY (%)
Headquarters or regional office staff	89.2
Country office or field office Staff	77.2
	p =. 027
Planning to use mobile technology to collect data in the next year	86.2
Not planning to use mobile technology to collect data in the next year	64.3
	p = .001
Total (n = 210)	81.9

Staff understanding of mobile technology systems within an organization was also an important measure of innovation–system fit measured in the survey. Overall, slightly fewer than a third of online survey respondents (32.9%) reported that staff at all levels (3.0%) or most levels (29.9%) understood how mobile technology could be used to improve M&E systems, while the majority (59.8%) reported that staff at most levels did not know (Table 14). There were significant differences for those who had used mobile technology or were planning to use mobile technology during the next year, with both groups reporting a higher likelihood of staff knowing how mobile technology could be used to benefit M&E systems (p < .001 for both) when compared with those who had not used mobile technology or were not planning to use it.

Table 14—Percentage and Level of Staff Understanding of Mobile Technology Use to Improve M&E Systems

LOCATION AND POSITION	STAFF AT ALL LEVELS KNOW (%)	STAFF AT MOST LEVELS KNOW (%)	MOST STAFF DO NOT KNOW (%)	NO ONE KNOWS (%)
Have previously used mobile technology to collect data	3.5	34.1	59.5	2.9
Have not previously used mobile technology to collect data	1.7	16.9	61.0	20.3
				p = < .001
Planning to use mobile technology to collect data in the next year	3.6	33.5	59.3	3.6
Not planning to use mobile technology to collect data in the next year	0.0	10.3	64.1	25.6
				p = < .001
Total (n = 234)	3.0	29.9	59.8	7.3

The role of data security in the adoption of mobile technology into M&E systems was another important component of innovation–system fit. Online survey respondents reported that the issue of data security was "very important" (49.1%) or "important" (37.6%). To add depth to their answers, 36 online survey respondents provided comments. For example, one noted, "The extent to which using mobile technology will enhance data security will determine its adoption." Online survey respondents' main issues on data security included, first, the need for confidentiality of personally identifiable information and other data and, second, the potential to guard against data loss. Generally, respondents were mixed on whether mobile technology would protect them from data loss. Another area of importance to respondents was protecting the data from unwanted intrusion, along with protecting data from manipulation. Finally, online survey respondents were concerned about how mobile technology systems would meld with government systems (especially when sensitive information is collected), given that many developing country governments are very sensitive about their data leaving national boundaries.

Where Does Mobile Technology Fit into INGO Programs?

Results from INGO Interviewees on Where Mobile Technology Fits into INGO Programs: INGO respondents described multiple uses of mobile technology for M&E systems within their organizations. The most basic function was data collection for surveys. But there were many varied ways of collecting

survey data. Some groups are still using PDAs for data collection in the field, but most have now moved to phones and some beyond phones to low-cost tablets. One organization, uniquely, reported collecting basic health data via SMS in a conflict area to ensure continued data flow. Many INGO interviewees told of using smartphones to collect program data. Some organizations undertake one-off data collection exercises, while others are collecting vast amounts of data in longitudinal studies. Many INGO respondents now use mobile technology as the preferred method for survey data collection.

Other INGO respondents reported tying service delivery applications such as clinical decision-support algorithms into data and linking the outcomes from patient encounters into their systems. INGO interviewees described using mobile phones as a tool to collect data on sensitive questions in at-risk populations. They also described mobile technology as a general documentation tool for programs. INGO interview respondents spoke about future uses of images as ways of documenting programs more effectively that could be facilitated by mobile technology programs. Surveillance (e.g., for malaria, tuberculosis, and neglected tropical diseases) was another use where technology was being used to map results via built-in or paired GPS in order to better visualize data. Simple improvements to be able to obtain basic data in real time were critical.

Donor reporting was another often-reported focus of mobile technology use for M&E systems—specifically, in order to make the data cleaner and more readily available. Some INGO interview respondents are taking M&E beyond the project level with the use of mobile systems that can serve to more easily centralize data and are looking at approaches to problems rather than at siloed, donor-funded projects. The lure of more centrally available and aggregated data was mentioned by several interview respondents as a reason for building M&E systems based on mobile technology. INGO respondents talked about the push from management within their own organizations to be able to aggregate their findings at a higher level and the interest in impact measurements and were hopeful that better data from the field level could help them with these measurements.

The last theme in who is using or not using mobile technology centers on the "hype" or "excitement" around mobile technology. This considerable buzz around mobile technology use appears to be driving its adoption.

> *"For better or for worse, a major driver is just excitement—excitement around the technology and excitement around mobiles in particular. And some folks have done a good job of advocating and driving that excitement. I mean, we see this everywhere. Even within the White House and the State Department, there is all sort of talk about technology and ICT [information and communications technology] and mobiles." (INGO Interviewee)*

But interview participants also reported times that mobile technology was seen as not necessarily beneficial. For example, INGO interviewees working in emergency settings were conflicted—although they needed the immediacy of mobile technology, an emergency isn't always the right time to introduce and use something new.

> *"People have their patterns—they know what they're doing. You can't come in when everything's utter chaos and try to change systems. I completely respect that, because it probably isn't the right time. So then I'm thinking, 'Well, how can we do some of this stuff ahead of time?'" (INGO Interviewee)*

One INGO interviewee reported that time spent helping his organization understand not only when to implement the technology but also when it might not be the best solution.

Although INGO interviewees had used mobile technology in health, the research also brought to light many examples of mobile technology used in other fields: agriculture, banking (mobile money), education, governance, relief work, for administrative functions (e.g., paying staff advances for travel), and other programming outside the health field.

Results from Platform Interviewees on Where Mobile Technology Fits into INGO Programs: Platform interviewees did not discuss how mobile technology fit into INGO programs in more detail than has already been presented in this section.

Results from Online Survey Respondents on Where Mobile Technology Fits into INGO Programs: Online survey respondents reported that they worked both in all health sectors and in non-health

sectors. Most respondents reported working in HIV/AIDS, reproductive health, maternal and child health, capacity development, and M&E. Mobile technology had been used most often in survey research, supply chain management, and social marketing—specifically, for behavior change communication. M&E was the fifth most common use of mobile technology among respondents (Table 15).

Table 15—Top 10 Health Sectors Where Mobile Technology Is Used

SECTOR	PERCENTAGE WHO REPORTED WORKING IN THIS SECTOR	PERCENTAGE WHO HAVE USED MOBILE TECHNOLOGY IN THIS SECTOR
1. Survey research	33.4	69.2
2. Supply chain management	14.1	63.6
3. Social marketing	9.0	60.7
4. Maternal and child health	43.1	56.7
5. M&E	39.9	55.6
6. HIV/AIDS	46.6	51.7
7. Reproductive health and family planning	30.5	46.3
8. Health information systems	21.2	45.5
9. Infectious and communicable disease	17.4	44.4
10. Non-health uses	11.6	44.4

Summary: Innovation–System Fit

Few INGOs have taken mobile technology to scale, and most appeared to be testing different platforms to understand what will work for them. There are strong relationships with platform providers and high levels of compatibility between INGO systems and mobile technology systems. For respondents who have an opinion on mobile technology platforms, there is a high level of agreement that the platforms have sufficient features and training materials, with some significant differences in subpopulations throughout the INGO community. However, interoperability remains an issue, especially when it comes to switching mobile forms between providers and in having common data definitions. A high number of respondents had seen colleagues in similar organizations using mobile technology. INGO key informant respondents did not consistently see mobile technology as a panacea, and the data showed that people who had not used the technology or who were not planning to use it over the next

year were still largely undecided about it and that many staff in these categories still do not know how mobile technology can be used to improve M&E systems in health.

Results on How INGOs Have Assessed Mobile Technology's Implications

The literature revealed that organizations that had fully assessed the implications of adopting an innovation had more success in assimilating it.[81,83] This section explores how INGOs have assessed the implications of mobile technology, together with information on organizational capacity to evaluate the innovation. Although the Greenhalgh model suggests that assessment of the implications and the capacity to evaluate an innovation are different components, the research reveals similar outcomes and information on these constructs. Three main themes emerged in this section:

- Evaluation of mobile technology initiatives.
- The role of evidence in driving the adoption of mobile technology.
- Strategy for mobile technology adoption.

The subsections that follow examine the findings in more detail.

Results on the Evaluation of Mobile Technology Initiatives

Results from INGO Interviewees on the Evaluation of Mobile Technology Initiatives: In the INGO interviews, directors did not generally report a great deal of evaluation of their efforts relating to mobile technology. Although they wanted to carry out additional assessments, time, funding, the need to implement programs, and capacity constrained their ability to undertake more rigorous and systematic evaluations. Mobile technology was not frequently evaluated because many projects were conceived as pilots rather than as implementation of a full program, and somehow in the piloting phase, evaluation (whether internal or external) was not considered essential. Evaluations that did occur focused more on

the technology's ability to function than on the outcomes of the technology or its cost-effectiveness. As noted in the Tension for Change section (page 96), a strong desire for additional evaluation of cost-effectiveness is pervasive.

One INGO interviewee commented that mobile technology did not easily lend itself to evaluation, because it was being used for monitoring, and when used for evaluation, was employed only for survey data collection. INGOs that have invested in evaluating mobile technology so as to be able to make a business case for its incorporation were further along the continuum of adoption than those that had not routinely evaluated their interventions. The evaluations that these INGOs have conducted, for example, determined that using mobile technology reduced labor on a project and improved data timeliness. The piece that challenges all organizations is how to put a monetary value on data timeliness and quality.

Some organizations had not conducted formal evaluations, although they had shared information with one another about "what had worked and what hadn't worked, to keep our different projects from making the same mistakes, and also to allow them to build on one another." Whether an organization had done a formal evaluation or had only shared information, INGO interviewees expressed the opinion that funding that focused the INGO's attention on conducting the evaluation (whether the funding came from overhead or from donors) was extremely limited. One INGO interviewee specifically named the lack of funding for evaluation as a barrier to completing a more rigorous evaluation.

Results from Platform Interviewees on the Evaluation of Mobile Technology Initiatives: None of the platform providers had been involved in helping INGOs to conduct assessments of the utility of mobile technology for their organizations. Although one platform provider reported having been called in as a consultant to help INGOs think through whether and what type of mobile technology they should use, none had officially been involved in evaluations. One platform provider was disappointed that a basic evaluation of the utility of mobile technology for data collection was still a publishable event,

explaining, "People still publish articles where the entire novelty of the article, the entire point of the article is to say 'We use mobile phones to collect data,' or 'We use SMS to remind people to come to clinic.'" This provider was hoping for more depth in evaluation of mobile technology.

Results from Online Survey Respondents on the Evaluation of Mobile Technology Initiatives: Only 33.1% of online survey respondents reported having ever conducted an evaluation of the utility of mobile technology for M&E systems in health (Table 16). Of this group, 16.1% reported conducting only a single evaluation; 17.0% reported having conducted more than one evaluation. M&E staff were significantly more likely to report having conducted an evaluation (p = .034), and respondents who had previously used mobile technology or who were planning to use mobile technology during the next year were more likely to have conducted an evaluation in the past (p = .033 and p = .008 respectively).

Table 16—Evaluations of Technology Use to Date

LOCATION AND POSITION	HAS EVALUATED THE UTILITY OF MOBILE TECHNOLOGY FOR M&E SYSTEMS (%)	
M&E professional staff	39.6	
Non-M&E professional staff	26.2	
		p = .034
Have previously used mobile technology to collect data	37.2	
Have NOT previously used mobile technology to collect data	21.2	
		p = .033
Planning to use mobile technology to collect data in the next year	36.2	
Not planning to use mobile technology to collect data in the next year	12.5	
		p = .008
Total (n = 218)	33.1	

Results on the Role of Evidence in the Adoption of Mobile Technology

Results from INGO Interviewees on How Evidence Drives Mobile Technology Adoption: INGO interviewees talked about their need for better evidence in the field of mHealth broadly, both for program applications and to make the business case for it.

> *"It's interesting to me that there's always this conversation about whether mobile health is working. There's not enough evidence of what are we doing with it. The fact of the matter is*

that data-driven decision making is well accepted. That's how we make better interventions in public health; that's how we identify problems and proceed . . . and mobile facilitates that. It's just a tool." (INGO Interviewee)

Yet evidence of the effectiveness of mobile technology has been lacking. One INGO interviewee summarized a possible reason:

"In my experience, it's not evidence of effectiveness or efficiency that's driving the adoption of mobile technology. It's again, the excitement, the interest. And then, there's sort of a second stage—'Well, let's find the evidence.' So this isn't evidence driven, and it's not research driven—at least not in my experience—because projects are running ahead doing things without worrying about evidence or . . . it's this interesting balance that we have to strike, between pushing ahead as well as making sure that we're doing things as much as possible in an evidence-based way, while also filling in the evidence gaps as we go along." (INGO Interviewee)

Results from Platform Interviewees and Online Survey Respondents on How Evidence Drives Mobile Technology Adoption: There were no survey questions on the topic, and platform providers did not report on mobile technology in this evaluative sense.

Results on Strategy for Mobile Technology Adoption

Results from INGO Interviewees on Mobile Technology Adoption Strategy: INGO interviewees were mixed on whether their organizations had official strategies on how to incorporate mobile technologies into their systems. Most said their organizations were in the process of developing a strategy paper—a fact that matches the survey data. After an official strategy has appeared, however, it can have an important impact on the ability to adopt mobile technology. In one case, for example, the organization's strategy helped it to determine the technical competencies needed in house to achieve innovation goals around mobile technology. Another organization used a strategy document to take a step back to look at project job descriptions to ensure that its staff had the appropriate technology skill sets.

Not having a fixed strategy but instead taking a flexible approach seems to work best for one INGO:

"I would say that [our process] is organic, but at the same time we have some strategic approaches that we're trying to implement. So, again, from the kind of central corporate perspective, we have a center for mobile health, which exists as a resource for projects to draw on as it's helpful to them, but [this center is] not a bottleneck. People who want to start a project don't have to go through us, because every individual project has its own clients and its own deliverables and needs some measure of autonomy when it comes to approaching a new intervention. So we've developed some tools and helpful approaches to that side of planning that are available to our teams." (INGO Interviewee)

Depending on the organization's structure (centralized or decentralized), the strategy or approach may take different forms. One interviewee noted:

"So we have these tools and strategies that we are putting forward as useful for our projects, and we find that they're being used regularly. But it's also a very organic thing, where the project's needs grow and change and drive some of the decisions." (INGO Interviewee)

Results from Platform Interviewees on Mobile Technology Adoption Strategy: Only two platform providers spoke about their observations on how INGOs are using strategy in the process of adopting mobile technology for M&E systems. One observed that INGOs do not appear in most cases to be using a strategy to guide their process:

"Organizations come to us with their [problem] and they say, 'We just want to get started with this particular data collection aspect.' And then they want to—once they see that this is successful, they say, 'Okay here's our long priority list.' And they literally do it one by one. They're not taking the time to sort of sit down and come out with a rational strategy." (Platform Interviewee)

Another provider had the opposite view and has observed a shift in INGO process toward the more rational strategy process:

"I really have seen a shift where people are tending more now to have buy-in of their organizations and to be responsive to something like an ICT strategy or an international strategy that says that they should try mainstream ICTs into their work, and that's where you start to get people saying, ''Okay, well, I have no idea what I'm doing.' They are less likely to try and figure out by themselves. They're more likely to try and leverage resources like us and pull in help where they need it. And then more likely to be interested in a countrywide or a multicountry rollout as an aim rather than just a first-level pilot. And I think that's good. I think that shows that ICTs are growing and that people's understanding is maturing and that people are starting to use them more routinely. (Platform Interviewee)

Results from Online Survey Respondents on Mobile Technology Adoption Strategy: Only 22.6% of online survey respondents reported that they had an organizational policy on integrating mobile technology into their M&E systems. Just over half of online survey respondents (50.2%) said that they did not have a policy, and 27.2% said they did not know.

According to the literature, setting targets for the inclusion of an innovation into a system and evaluation of the innovation are precursors to adopting it. Only 27.8% of online survey respondents reported having set targets for including mobile technology in their M&E systems.

Summary: INGO Assessments of Mobile Technology's Implications

Of online research participants, only 22.6% reported having an organizational policy on integrating mobile technology into their M&E systems, and only 27.8% said they had set targets to ensure the integration of mobile technology. Similarly, only 33.1% reported that their organization had conducted one or more evaluations of the utility of mobile technology for their M&E systems. Evaluation processes and following a strategy was not reported routinely by INGO or platform interviewees. In summary, the move toward mobile technology was not being driven by specific evidence.

Results Relating to Support and Advocacy for Change

If leadership and management are behind an innovation or if there are internal champions for the innovation, it is more likely to be adopted. This section looks at the receptive context for change—specifically:

- Organizational or direct leadership support for the use of mobile technology for M&E systems.
- Where mobile technology lives in an organization.

Results Relating to Leadership Support for Mobile Technology

Results from INGO Interviewees on Leadership Support: INGOs have had mixed experience with leadership in support of mobile technology in their systems (and as a part of that their M&E systems). Executive leaders have both provided direct support in three organizations and resisted change in two organizations.

Two broad models that are directly affected by the concept of support and advocacy appear to shape how mobile technology is being adopted in INGOs. In one model, support for mobile technology begins with field personnel who have successfully used the technology, and support for the organization-wide adoption of mobile technology develops after someone at headquarters sees its utility and helps to coordinate efforts to adopt it.

In the second model for the adoption of mobile technology, its utility is seen centrally and the center then pushes for staff outside the center to adopt the technology to enhance organizational efficiency. This model is much more affected by central-level support and advocacy—where, for example, a member of a senior executive staff or of the technical team comes forward supporting the initiative and makes resources available to push it forward.

> *"There are two very different types of individual. The leadership group is providing strategic guidance and leadership and not really doing daily implementation, whereas champions are more . . . involved in the day-to-day activities of implementation—[individuals] who from*

their own motivation, adopted some of these technologies and approaches. So you're working from two different parts of the organization—from the very high-level, centralized leadership group and from this very diffuse, decentralized place of the individual champions on individual projects." (INGO Interviewee)

One INGO interview respondent described resistance to change in her organization and having to "beg" a division chief for the funds to have a presence at the mHealth summit. Although pleading for resources to undertake an initiative within an INGO is not unusual and may not signal resistance, other INGO interviewees reported definite resistance:

"In the humanitarian development field, you have people from the old guard who are very, very resistant to doing things in a new way. I was actually told that one of our regional directors was explicitly against the use of mobile phone technology in our programs. Another person I talked to, someone who's connected with the humanitarian work and is using mobile phones to do assessments—that would include health assessments in an emergency situation—that person got feedback from colleagues who are saying they felt that mobile technology took—and this is a quote—'the humanity out of humanitarian work.' Which [shows] some of the resistance." (INGO Interviewee)

Less clear was the best method for making INGO leadership cognizant of mobile technology and getting them to engage with it in this world of competing interests and scarce resources.

Among INGO interviewees (those sitting at the center themselves), there was consensus that taking mobile technology to scale within an organization requires central support or coordination from the organizational center, even in decentralized organizations. This support might take the form of information sharing, experience sharing, troubleshooting problems, or assistance in considering options. The role of the champions and of "boundary spanners" (people who help link practitioners together within and among INGOs), who are taking the technology forward and who are linking the organization with outside entities who can take the technology forward, was important to INGO interviewees in order to move toward adoption of mobile technology for M&E systems.

One INGO interviewee referred to "the flexibility and interest of senior management" that permitted the creation of a center to coordinate mobile technology use across projects:

"A big reason why we've been able to achieve so much is because we've had some level of coordination across projects, and that came only because [our INGO] as an entity was willing to invest some overhead in this [technology]." (INGO Interviewee)

So, although it is possible that mobile technology could become incorporated organizationally even without senior leadership support—given enough interest and use at the field level and by working with platform providers—it appears that leadership support speeds and aids the process.

"When something comes from the executive office, [that project or initiative] receives a lot of attention, [especially when that executive] is in the position to really dedicate resources and say, 'You're going to help us work on this.' Anything coming out of the executive office has the most power behind it." (INGO Interviewee)

Results from Platform Interviewees on Leadership Support: Platform providers saw leadership as important to the adoption of mobile technology. But they also observed that extensive staff use of the technology helped organizations gain traction in the area. One platform provider reported working first with "program managers," next with "country representatives," and finally with a "boundary spanner" within an organization, able to provide links to other parts of the organization. This provider called these people "Johnny Appleseeds" and described them as:

"[People] at headquarters level who can, either through mass communication or by actually going to these places and saying, 'Look guys, it's 2013. It's a brave new world. You've got this incredible investment and infrastructure. You need to make this change,' to set some sort of minimum standards that say that we have a goal as an organization." (Platform Interviewee)

Platform providers also recognized that leadership plays a key role in helping overcome resistance to change within organizations. One provider noted:

"Either because of corruption or just because of human nature, there is a fear factor associated with things that are new. We have to be able to sort of overcome them. And good leaders will manage that change by being directly involved on a regular basis, so it's absolutely positively critical." (Platform Interviewee)

While INGO interviewees were more likely to point out a need for an executive champion within the organization to secure traction for the move toward mobile technology, platform providers were

finding those people at a more technical level, perhaps in the IT sector or in the program's technical sector. In either case, platform providers recognized the importance of those able to translate the potential of mobile technology to other key parts of the organization.

Results from Online Survey Respondents on Leadership Support: Online survey respondents reported high levels (72.8%) of management support for the adoption of mobile technology. Although the percentage was low among those reporting that management did not support mobile technology for M&E (4.6%), the remainder of respondents were unsure whether management supported mobile technology (22.6%). Of respondents who were sure about their management's stance, there were no significant differences between headquarters and field staff, between M&E and non-M&E staff, or between those planning to use mobile technology during the next year and those not planning to use it.

Online survey respondents reported an even higher level (76.5%) of boundary spanners in their organizations. Although the percentage reporting an absence of boundary spanners was low (9.5%), the remainder of respondents were unsure whether there were boundary spanners in their organizations (14.0%). Of respondents who were not unsure, there were no significant differences between headquarters and field staff, between M&E and non-M&E staff, or between those planning and those not planning to use mobile technology over the next year.

Results: Who Is Responsible for Mobile Technology in M&E Systems?

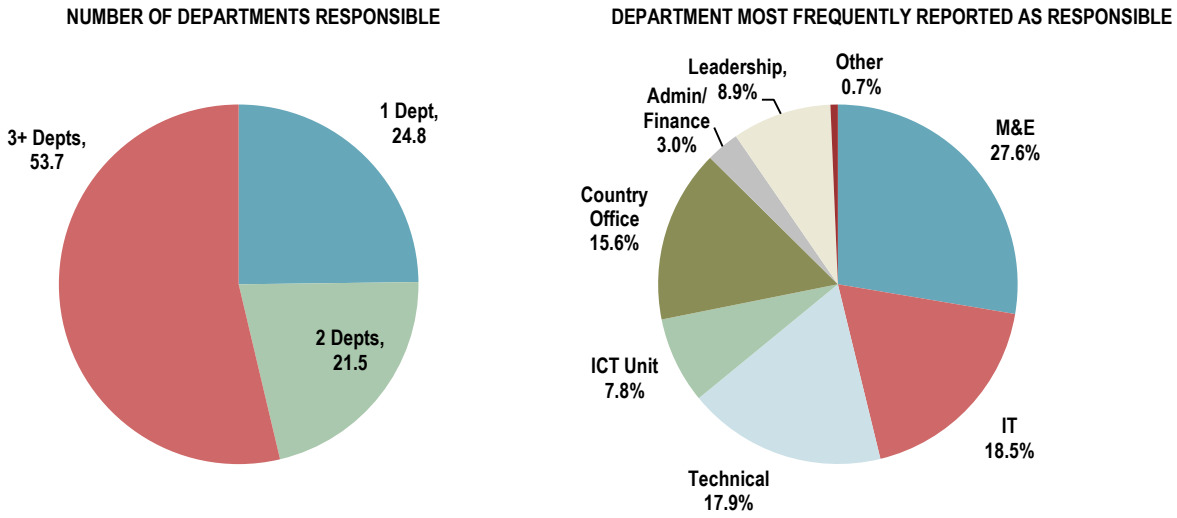
Results from INGO Interviewees on the Seat of Responsibility for Mobile Technology Innovation: In at least one INGO, responsibility for incorporating mobile technology into M&E systems was seen as the IT department's job. In most others, it was viewed either as the job of the M&E unit or as a cross-functional role. More often than not, INGO interviewees reported that the job fell to the M&E unit but that the work to make it happen was done in coordination with program managers and IT personnel. Many INGOs described that working groups were looking at ICT more broadly rather than rather than a specific working group studying M&E issues alone. Membership in these working groups tends to span

organizations' IT and technical arms (with the notable absence of administrative groups such as grants management and finance).

Results from Platform Interviewees on the Seat of Responsibility for Mobile Technology Innovation: Platform providers largely concurred with INGO interviewees that a mix of IT, M&E departments, and sometimes technical units was involved in using mobile technology for M&E systems. However, platform providers tended to interact with IT departments more frequently and see a bigger role for IT departments in the process than INGOs reported.

Results from Online Survey Respondents on the Seat of Responsibility for Mobile Technology Innovation: In the online survey, 24.8% of respondents said the responsibility for incorporating mobile technology into M&E systems lay with a single department, while 21.5% said it was shared by two departments, and 53.7% as residing with three or more departments (Figure 8).

Figure 8—Integrating Mobile Technology into M&E Systems



Most commonly, the M&E department was named as responsible (27.8%), followed by the IT team (18.5%), the technical team (17.9%), and the country office teams (15.6%; Figure 8). It seems that

responsibility for mobile technology in M&E systems is well integrated throughout the organizations of most online survey respondents.

Summary: Results Relating to Support and Advocacy for Change

Overall, INGO interviewees and online survey respondents reported high levels of support from their management for incorporation of mobile technology into M&E systems and noted that, in addition, there were high numbers of boundary spanners providing links to different parts of the organization or outside the organization. These results were confirmed by the online survey respondents who reported high levels of management support (72.8%) and high percentages of boundary spanners within their organizations (76.5%). There was still a relatively high percentage of online survey respondents who were unsure of whether their organization had management support for the introduction of mobile technology for M&E (22.6%) or had boundary spanners (14.0%).

Mobile technology was shown to be well integrated and spread throughout the organizations of most research participants, and M&E departments were most commonly responsible.

Results Relating to Dedicated Time and Resources

When an organization devotes time and resources to an innovation—especially ongoing resources—the chances of that innovation being adopted increase.[79,83] This section examines structural determinants of innovativeness, including:

- Resources committed to mobile technology.
- The role of donors and the sustainability of mobile technology in M&E systems.

Results Relating to Resources Committed to Mobile Technology

Results from INGO Interviewees on Dedicated Resources: One key resource that many INGO respondents mentioned—participation of key personnel in external working groups—has been

important in maintaining momentum and updating practitioners' knowledge for their own organizations. The mHealth community is a very collaborative space, and volumes of information are shared on listservs (e.g., the mHealth Alliance and mHealth Working Group e-mail lists) and within LinkedIn groups (e.g., mHealth, ICT4D, Global ICT4D Network, and ICT4D in Africa). In the words of one INGO interviewee, the mHealth working group is "a really good incubator for discussion among different people as to what provider do you use, what phone do you use, is this realistic, and who else can I talk to?"

Several INGO interviewees reported that their organizations had formed cross-departmental internal working groups on mobile technology and that these groups had played a key role in helping to promote mobile technology, for both M&E and other uses. In two INGOs, senior management supported these forums, and this support was viewed as an important facilitator for mobile technology's adoption within the organization.

Interviewees reported that internal working groups met weekly or monthly and focused on sharing information and pushing small initiatives out to the larger community within their organization. They focused on information sharing around technologies that have been used in the field and on promoting organizational learning. Alternatively, these working groups communicated virtually, via listservs, to share information and learning on mobile technology uses. INGOs that did not have an internal working group were moving more slowly toward mobile technology uptake. External forums for information sharing were another important catalyst for INGOs adopting mobile technology for data collecting.

A few INGOs are approaching mobile technology by writing it into proposals, and they move forward with implementation if the proposed project is funded. This approach leverages project funding rather than funding from overhead, which requires a central investment in mobile technology. INGO interviewees' mobile technology initiatives are predominantly project funded. Leaders within these

organizations are trying to take mobile technology forward using specific project funds and pooling learning where possible. On the other hand, some INGOs have made specific overhead investments in introducing mobile technology; they are moving toward more centralized systems more quickly than those who are trying to build a portfolio project by project. Where IT teams are leading the push for mobile technology incorporation or where there is a strong IT role, there is often central overhead funding support. At least two organizations reported having central innovation funds to catalyze support for mobile technology adoption, but at very different magnitudes—one of them organizationally and the other for a particular project.

Whereas IT positions tend to rely on overhead for funding, M&E positions tend to be funded at least partially by projects. Thus, there is less direct investment in M&E or technical positions' focusing on mobile technology, for example, because funding is supporting technical work on projects (with mobile technology as just one facet of those projects). Few INGOs have invested in staff who are focusing solely on putting mobile technology into their organizational systems. Those that have invested are proceeding more quickly and more systematically.

At least three INGO interviewees reported developing training materials for staff. Although some mobile technology platform providers would like their platform to be completely intuitive, INGOs are still feeling that they need to take their staff through a process—and, indeed, some INGO staff are waiting for consultants to come out and "train" them (personal communication from an online survey respondent asking whether he was eligible to participate in the survey since he was waiting to be trained by consultants, May 16, 2013).

At least one INGO interviewee mentioned the cost of training for staff at field level as being the real cost associated with mobile technology:

> *"One of our pilots showed us . . . [that] cost is not necessarily in cost around the phones, although we're going to get more into using the Android phones, so there are those costs. But the significant costs in terms of opportunity cost and . . . financial cost are at the training level." (INGO Interviewee)*

Another INGO interviewee recognized that his organization's approach to training was still in the formative period:

> *"There isn't, specifically yet, any sort of training provided, but again, I say 'yet,' because we're in the early stages of really figuring out how we want to do this effectively at the organization. I would expect that there will be some amount of internal capacity building . . . some targeting of developing at least a basic level of understanding of ICT in mobile technology and how that can and should be effectively integrated into project activities, including M&E." (INGO Interviewee)*

Results from Platform Interviewees on Dedicated Resources: Platform providers see that INGOs are drawing on a mix of project and overhead funding to implement mobile technology in their M&E systems. But at least one provider was hopeful that INGOs will change this approach:

> *"Our goal is to get organizations so hooked on mobile data collection that it becomes an overhead expense. Our goal is to try to get the price down to the point where it's kind of like paying your phone bill or paying your electric bill. You just pay it because you can't imagine life without it." (Platform Interviewee)*

In terms of investments in training, providers were divided. Some platform providers want to be involved in helping organizations set up systems, and part of their business model is to collect fees for this type of support. Others would like to provide basic training materials and let INGOs figure out the best uses of their platform. One provider noted:

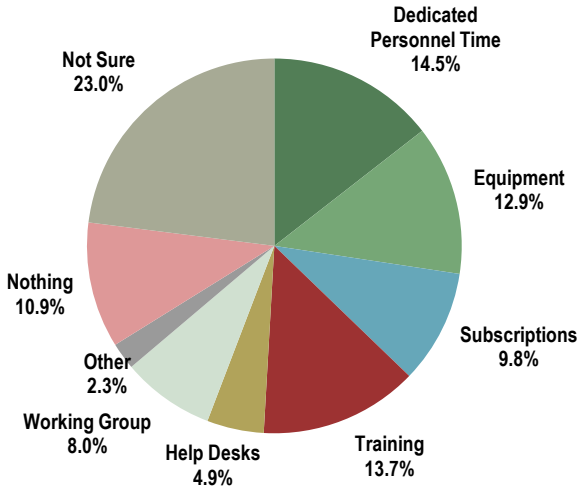
> *"If you're an organization that makes let's say 75% of your money by doing technology trainings and implementations, what's your incentive to make simpler technology that requires no training? Zero. You're basically shooting yourself in the foot." (Platform Interviewee)*

Platform providers did not recognize the INGO need for training for staff on how to select a platform. Rather, their focus was on how INGOs could best use their platform and plan for mobile technology work in their organizations. One provider explained:

> *"On-the-ground organization and training are also very important. From what we've seen, usually people don't put it in the budget or didn't think about it enough—on-the-ground organization, how many devices you need, how you roll them out, in case of an issue, what do you do (how do you ship it back or do you have on-the-ground IT support), who will be doing the training, who will be doing the collecting or the end-user or the beneficiaries or you have volunteers, how do you train them?" (Platform Interviewee)*

Results from Online Survey Respondents on Dedicated Resources: Online survey respondents did not report internal or external working groups or discussion boards as a major resource provided by organizations to their employees. Respondents reported participating in these only 8.0% of the time (Figure 9).

Figure 9—What INGOs Use to Support Mobile Technology Inclusion in M&E Systems



Overall, it appears that organizations are investing few resources in mobile technology for M&E systems. Little dedicated personnel time, little equipment, and few subscriptions were reported. However, given the relatively high "not sure" response to this question (23.0%), it is possible that more has been provided than respondents have reported.

Results Relating to the Role of Donors and Sustainability

Results from INGO Interviewees on the Role of Donors and Sustainability: INGO interviewees' opinions on the role that donors play in the adoption of mobile technology in M&E systems were mixed. Although the Gates Foundation and a few others had pushed for early development and use of mobile technology, major US donors such as the United States Agency for International Development were not seen as leaders in the field, despite recent efforts. Donor silence on mobile technology was summed up thusly:

"They don't want to spend a lot of money, and they don't want to distract the attention from the outcome." (INGO Interviewee)

A few INGO interviewees admitted to putting mobile technology into their proposals to appeal to donors. Another described an organizational move toward mobile technology as a reaction to donor requests rather than as an internal effort to make M&E systems more efficient.

For some INGO interviewees, the creation of mobile technology–driven internal M&E systems to measure progress on projects did not raise issues around sustainability. But for others who provide service delivery, especially when working with national governments, the sustainability of mobile technology systems was a concern. Deciding which costing model would be a good fit with a particular project's needs is one of the most difficult issues INGOs must consider in their move toward mobile technology. Two INGO interviewees summarized the issue of sustainability:

"As an NGO, we have to understand the value chain and the business models of the people working in the value chain . . . so that we can look at who will pay for a service based on getting a return on that investment—what the benefit to them is. . . . That's important for us to learn." (INGO Interviewee)

"An intervention can work just fine but still not be sustainable, because it relies on some extra expense that nobody is willing to cover or because it doesn't scale—in other words, it's built on some technology that isn't useful for the broader population that you're aiming at. Sustainability is absolutely vital. It's one of our pieces—one of the top five mobile health things that we are recommending to our organization: plan for scalability and sustainability from the beginning, so that even though you may pilot only with one district or something, your eye is always on how this thing would scale through the country and what would make it sustainable going forward." (INGO Interviewee)

Results from Platform Interviewees on the Role of Donors and Sustainability: Overall, platform providers felt that donors had not done much to influence the field and that although more calls for proposals had been mentioning mobile technology or calling for the use of mobile technology, it was not yet considered a standard approach. Many platform providers expressed that donors had really not played a strong role in moving mobile technology forward but that they could do so if they called explicitly for the use of mobile technology in their requests for applications and requests for proposals.

One platform provider spoke eloquently about sustaining his business model by taking a "freemium" approach, making the technology available at a charge for those with a large need, with their fees supporting free use by all others.

Results from Online Survey Respondents on the Role of Donors and Sustainability: Online survey respondents felt that donors did have a key role to play in the adoption of mobile technology into M&E systems. Because the survey question inquired about donor roles in the future rather than in the past, it appears that donors could still play a major role in supporting the use of mobile technology for M&E systems (Appendix 4, Figure A).

Summary: Results Relating to Dedicated Time and Resources

Most organizations have not yet made the type of major investments in mobile technology for M&E systems that they have in IT infrastructure for their organizations. Few organizations have dedicated units or personnel for the introduction of mobile technology, and where personnel do exist, they rarely give all their time to broadly integrating mobile technology into M&E systems, but instead have other activities competing for their time—for example, supporting specific projects or other M&E responsibilities. Many INGOs are in the process of developing training materials for their staff, but few have made such materials publicly available.

INGO interviewees and other research participants were split on the issue of sustainability of mobile technology systems, some feeling that ensuring sustainability in their business model was critical and others viewing mobile technology as just a tool that, like a computer, requires an investment to get the job done. They were equally split on the role of donors in promoting mobile technology for M&E systems. Although donor requirements for the use of mobile technology could push adoption forward more quickly, donors have often been silent on the "how" of program implementation and do not require any specific methods.

Results on Organizational Readiness for Change

"I think by and large organizations . . . can change. But most of them don't."

(Platform Interviewee)

The final dimension on DOI in health service organizations presented by Greenhalgh—in the center of the figure—refers to inner-organizational context and organizational readiness for change. Linking to the other areas, organizational readiness for change is a keystone. Without readiness for change at the organizational level, little will be achieved.

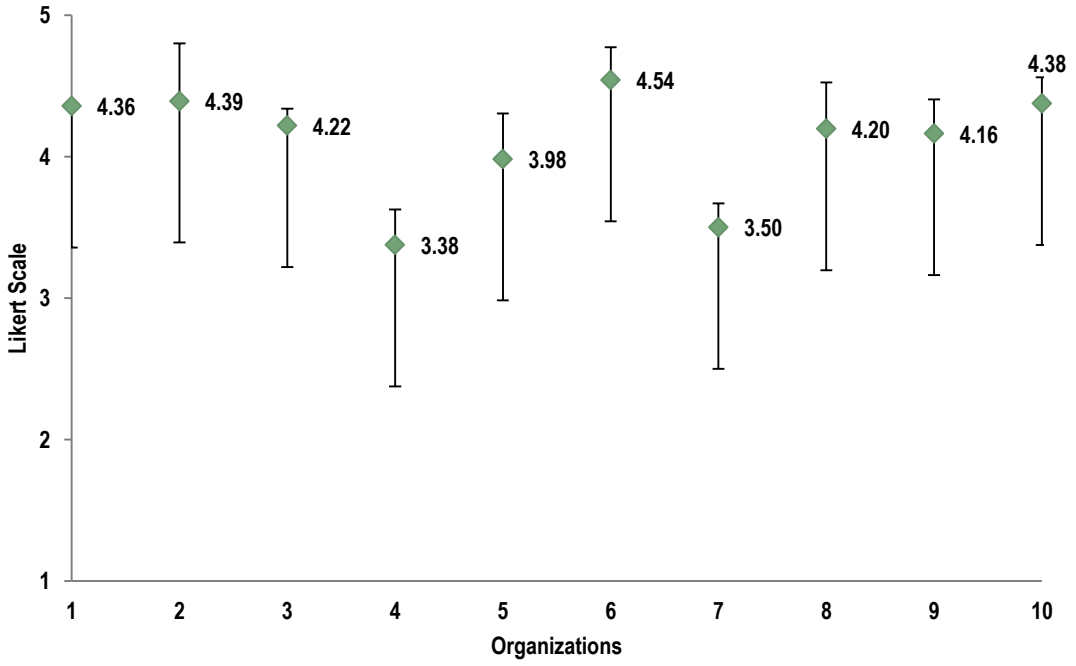
Using previously validated constructs developed by Weiner et al. (Bryan J. Weiner, personal communication, March 18, 2013), 18 statements were used in the online survey to gauge organizational readiness for change, measured through the constructs of: change commitment; change efficacy; task knowledge; and resource availability. The statements were measured on a five-point Likert scale, where 1 meant "disagree," 2 "somewhat disagree," 3 "neither agree nor disagree," 4 "somewhat agree," and 5 "agree." All data were collected as part of the survey, and organizations that had a total of six or more respondents were included in this assessment. Ten INGOs met these criteria. For each construct, the mean score of organizations that are "ready for change" should be more than 3—preferably more than 4—indicating overall agreement. The results are presented below for each construct against the results for all organizations that did not have more than six respondents, averaged together. The Cronbach's alpha for all constructs was higher than .700, and the intraclass coefficient analysis showed high levels of reliability for the constructs (Table 6).

Results on Metric 1: Change Commitment

The first metric of organizational readiness for change, change commitment, refers to "organizational members' shared resolve to pursue the courses of action involved in change implementation."[89] To build the construct, the survey used an average of the means of four statements:

- We are motivated to implement mobile technology for M&E.
- We are determined to implement mobile technology for M&E.
- We want to implement mobile technology for M&E.
- We are committed to implementing mobile technology for M&E.

Figure 10—Change Commitment Means (SEM)



The mean for all respondents to the survey for this metric was 4.10 (± .06). Figure 10 presents the mean and standard error of the mean (SEM) for change commitment for respondents from the 10 organizations that had more than six respondents. Mean scores for all INGOs for change commitment were above 3, the neutral category—below 4, "somewhat agree," for three of the 10 organizations.

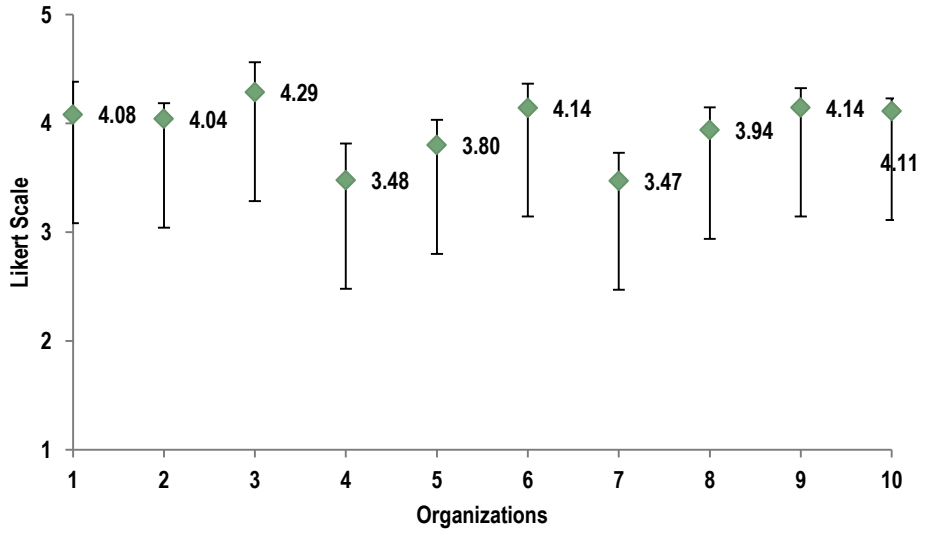
Overall, in this grouping of INGOs, there is a level of high commitment to implementing mobile technology for M&E.

Results on Metric 2: Change Efficacy

The second metric, change efficacy, refers to "organizational members' shared beliefs in their collective capabilities to organize and execute the courses of action involved in change implementation."[89] To build the construct, the survey used the mean score for seven statements:

- We can manage the politics of implementing mobile technology for M&E.
- We can coordinate tasks so that implementation of mobile technology in M&E systems goes smoothly.
- We can handle the challenges that might arise in implementing mobile technology in M&E.
- We can keep the momentum going in implementing mobile technology for M&E.
- We can support staff as they adjust to implementing mobile technology for M&E.
- We can keep track of our progress in implementing mobile technology.
- We can get staff invested in implementing mobile technology for M&E.

Figure 11—Change Efficacy Means (SEM)



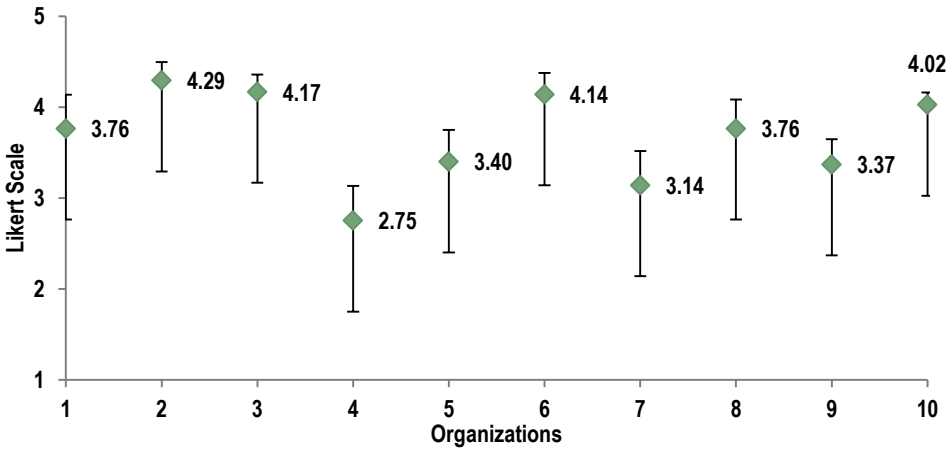
The mean for all respondents to the survey for this metric was 3.96 (± .05). All 10 INGOs in the assessment scored above 3, the neutral category; four of the 10 scored below 4 (Figure 11). The constructs with the two lowest means were those about managing the politics and coordinating tasks for a smooth transition. Overall, in this grouping of INGOs, there is a high level of change efficacy for implementing mobile technology for M&E systems.

Results on Metric 3: Task Knowledge

The third metric in the organizational readiness for change model is task knowledge, a knowledge of how to complete the task paired with an understanding of the resources that will be required. To build the construct, the survey used the mean scores of three statements:

- We know what steps are involved in implementing mobile technology for M&E systems.
- We know what we need to do to implement mobile technology for M&E.
- We know what resources we will need to implement mobile technology for M&E.

Figure 12—Task Knowledge Means (SEM)



The mean for task knowledge considering all respondents to the survey was 3.73 (± .03). One of the 10 INGOs with more than six respondents scored below 3, the neutral category; five scored below 4, "somewhat agree" and the remaining four organizations scored above 4 (Figure 12). Organizations that

scored below 4 were not clear what steps are involved in implementing mobile technology for M&E systems, what they needed to do, and what resources they would need to implement mobile technology for M&E—all statements used to build the construct.

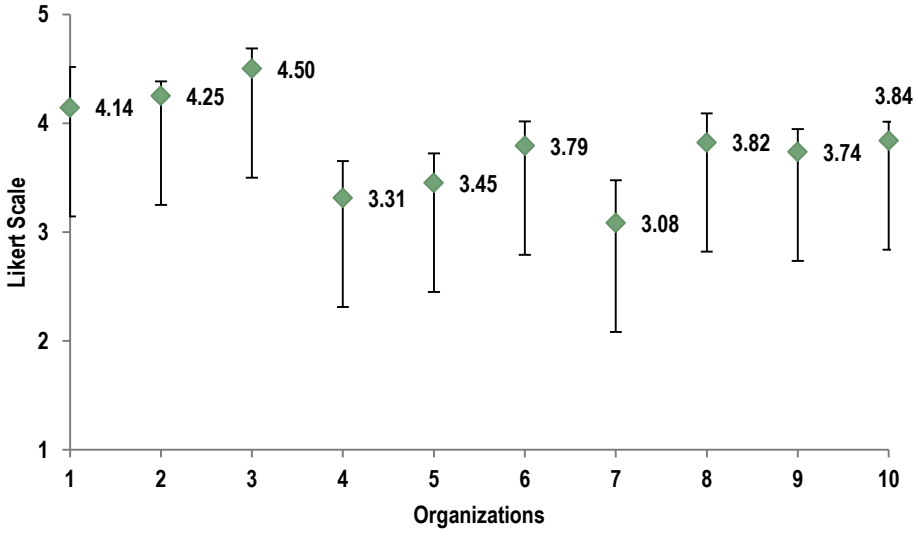
Results on Metric 4: Resource Availability

The fourth metric in measuring an organization's readiness for change is resource availability, specifically availability of the human resource skills (both knowledge and presence) needed to implement the change. To build the construct, the survey used the average of the means of two statements:

- We have the skills to implement mobile technology for M&E.
- We have the staff to implement mobile technology for M&E.

The mean for resource availability for all research participants was 3.78 (± .06). All 10 INGOs that had more than six respondents in the assessment scored above 3, the neutral category; seven scored

Figure 13—Resource Availability Means (SEM)

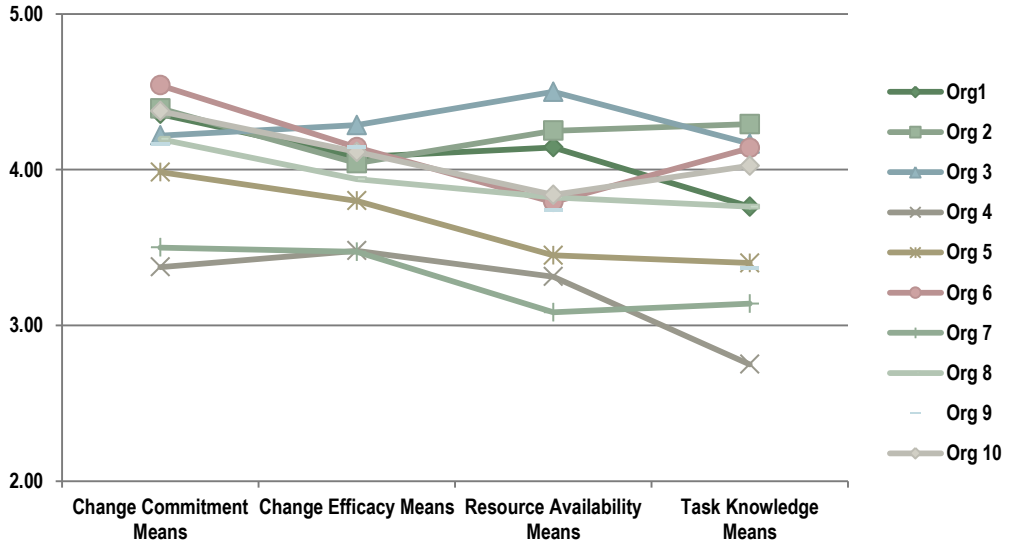


below 4 (Figure 13). Although the mean score was slightly higher than for task knowledge, the seven organizations that scored below 4 point to continuing uncertainty in this area.

Results: Organizational Trends

Overall, most organizations scored highest on change commitment and lowest on task knowledge means (Figure 14). Results for Change Efficacy were most closely clustered together.

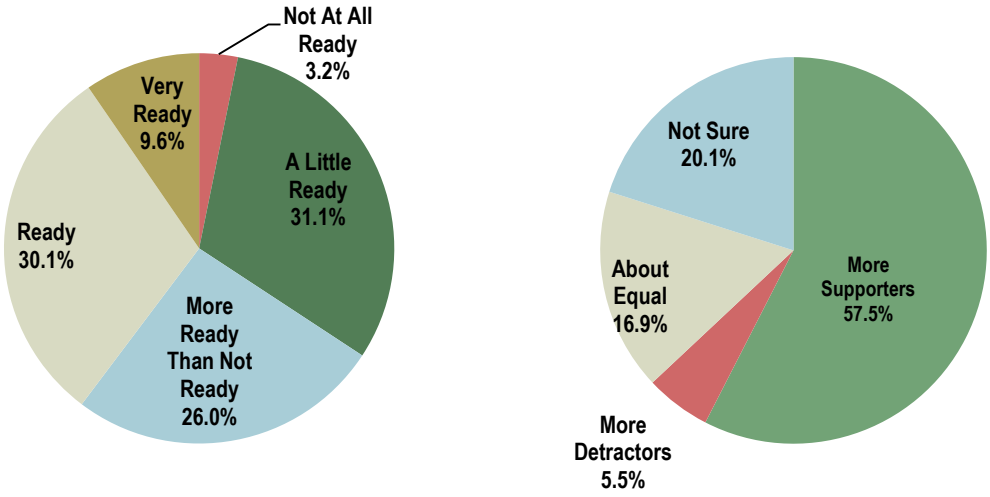
Figure 14—Organizational Trends by Organizational-Readiness-for-Change Construct



Results: Are Organizations Really Ready to Change?

When asked directly how ready survey respondents were to change and to implement mobile technology for M&E, 9.6% replied "very ready," 30.1% said "ready," and 26.0% reported being "more ready than not ready" (Figure 15). When asked whether there were more supporters or detractors in their organization on the topic of mobile technology in M&E systems, 57.5% of online survey respondents reported more supporters than detractors (Figure 15).

Figure 15—Online Survey Respondents' and Organizations' Readiness for Change



Summary: Results of Online Survey Respondents' Readiness for Change

Organizational readiness for change among INGOs in the assessment is high. Mean scores for change efficacy and change commitment were above 4 (agree) or very close to this level. Mean scores were relatively lower for task knowledge and resource availability.

More than half of online survey respondents reported that they are more ready than not ready to change and more than half of respondents reported that there were more supporters of mobile technology for M&E systems than detractors.

Results Relating to Facilitators and Barriers to the Adoption of Mobile Technology

All study participants were asked to discuss major facilitators and barriers to the adoption of mobile technology into M&E systems for health. Major points are presented below.

Results Relating to Facilitators of Mobile Technology Adoption

Results from INGO Interviewees on the Facilitators of Mobile Technology Adoption: For INGO interviewees, the previously mentioned hype and buzz around mobile technology facilitated adoption. According to these interviewees, people want to try mobile technology, use it, and understand how it

can make their systems more efficient and effective. INGO interviewees termed the "status symbol" of mobile technology use as another facilitator. For example, community health workers appreciated using mobile technology in their work:

> *"In some cases, the enumerators came back and said, 'Yeah, I think I got more attention, like I seemed more official.' And so [the community] sort of gave it a little bit more weight when they were responding." (INGO Interviewee)*

Another facilitator that INGO interviewees mentioned was the ubiquity of mobile phones and widespread familiarity with them and how they can work in even low literate and low numerate communities.

One facilitator mentioned by online survey respondents and described by INGO interviewees was the sharing of information and experiences within organizations and within the mHealth community. Two INGO interviewees said:

> *"There's no substitute for experience—like just watching and observing how phones are being used, what's going right, what's going wrong." (INGO Interviewee)*

> *"When a project has good success with something, we are able to use resources from that project and from the experts that are working on that project, and we share that information with the rest of the teams and our field teams. And I think that can get people going and help start turning wheels and generating ideas about how we can . . . really harness mobile technologies." (INGO Interviewee)*

Sharing beyond organizational boundaries is a related facilitator:

> *"Sharing this information, and, you know, starting everybody to talking about it is only a net benefit for us public health practitioners. That's how we're going to keep up with the rate of innovation—by sharing as quickly as possible what we're learning." (INGO Interviewee)*

INGO interviewees said they didn't feel that donors were playing a major role, except in their support for the sharing of platforms and groups that are promoting mHealth—specifically, the mHealth working group and the mHealth Alliance.

Management buy-in to mobile technology was mentioned as important by several INGO interviewees (and by online survey respondents). Executive leadership or support was seen as an

especially strong facilitator or adoption, supported by organizational champions (especially technical champions) helping to roll out the technology to the field and get people started.

Beyond reaching out beyond organizational boundaries, there is a keen interest among INGO interviewees in the public–private partnerships that can be forged with mobile technology platform providers as a facilitator for the adoption of mobile technology.

Results from Platform Interviewees on the Facilitators for Mobile Technology Adoption: The nearly universal availability of phones in the settings where public health programming is being conducted was mentioned more frequently by platform interviewees as a facilitator of the adoption of mobile technology for M&E in health.

Platform providers agreed that donors were not playing a significant role in facilitating the adoption of mobile technology despite having the power to do so. One provider wondered when major donors like USAID would recognize the cost-efficiency of mobile technology platforms and questioned why organizations were not moving in that direction.

> *"Eventually . . . USAID is going to be looking at NGOs[nongovernmental organizations] and what they do for monitoring and evaluation, and, eventually, it's going to be a great day when someone at USAID says, 'Hold on, you guys have $100,000 budgeted for data collection? Why aren't you using [mobile technology]?'" (Platform Interviewee)*

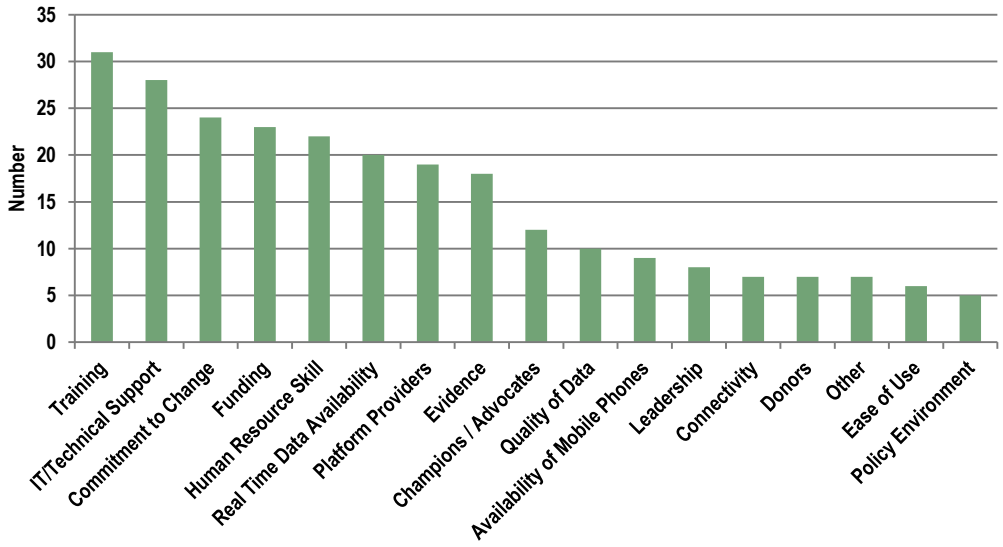
Results from Online Survey Respondents on the Facilitators to Mobile Technology Adoption: A total of 158 online survey respondents (50.8%) left a written remark in this section of the survey. Survey responses were post-coded and added to the main dataset. Overall, the top five facilitators of the adoption of mobile technology into M&E systems named by online survey respondents were:

- Training of field staff and partners to improve their capacity to implement mobile technology.
- IT/technical support for the implementation of mobile technology and, specifically, support to understand how to get started and how to implement mobile technology for their setting and their systems.

- Staff members' commitment to change and to adopting mobile technology, especially their interest in using mobile technology for their systems.
- Funding—both overhead funding and project funding—which means writing mobile technology implementation into proposals.
- Human resources and staff skills and staff members' ability to actually implement mobile technology.

Other key facilitators of the adoption of mobile technology beyond the top five, such as real-time data availability, partnerships with platform providers, increasing evidence that mobile technology is effective, internal champions, and the like, are presented in Figure 15.

Figure 16—Facilitators of the Adoption of Mobile Technology



Depending on where they were based, online survey respondents differed in what they perceived as facilitators for the adoption of mobile technology. Headquarters-based respondents saw the main facilitators as the commitment to change (25.0%) and the increasing need for real-time data availability to use for decision making (20.8%). The perspective of those based in the country offices was more practical. From that viewpoint, the prime facilitator was the availability of training that would enable staff to implement the technology in their setting (25.0%), followed by the availability of IT and technical

capacity to support mobile technology's implementation in M&E systems (19.8%) and then by the availability of skilled human resources that could implement mobile technology initiatives (16.7%) and by increasing funding for mobile technology work (16.7%).

In summary, there are many facilitators to the adoption of mobile technology, and the importance of these differs as a result of individual commentators' differing perspectives. One online survey respondent summarized many of the main facilitators as:

> *"Availability of cross-platform apps, cheap yet durable devices, more user control over the tools, a powerful front-end control system, and high-speed Internet, not to mention—ahead of everything else—the change in people's mindset about the adoption of the technology." (Online Survey Respondent)*

Results Relating to Barriers to Mobile Technology Adoption

> *"What's not driving or facilitating the adoption is evidence."*
>
> (INGO Interviewee)

All INGO and platform interviewees and online survey respondents answered a question about barriers to the adoption of mobile technology for M&E systems in health programs.

Results from INGO Interviewees on the Barriers to Mobile Technology Adoption: INGO interviewees largely agreed with online survey respondents' perception of the barriers to the adoption of mobile technology (page 97) but offered more detail on why these barriers exist. One INGO interviewee talked about how mobile technology started out as a technical conversation that did not "speak to" global health professionals, preventing a more rapid uptake.

> *"When I started getting into [mobile technology], the only people talking about this [were the members of this] very close community of technology people. They were the only ones who were talking about mHealth. And the problem was that in the discussion and discourse, they were not including global health specialists . . . and a lot of the discourse, up until fairly recently, had been among the technology people and computer types. And they were using a lexicon that did not resonate with the global health specialists. Now that has been changing, and more and more global health specialists are being included in the conversations, and what we're talking about right now is resonating with them, and they're trying to pay attention to the evidence." (INGO Interviewee)*

Results from Platform Interviewees on Barriers to Mobile Technology Adoption: One platform provider spoke eloquently about the perceived costs of mobile technology platforms being just that—"perceived"—and noted that the costs were really often much lower than for paper-based systems:

> *"[An INGO has a program] where they have hundreds of rural community health workers who, every week, send a formatted text message containing, among other things, the number of births, the number of deaths, and a few other pieces of information. This results in something that no one else in any developing country has—a near real-time system of measuring mortality rate and birth rate. The cost is a total of about $5,200 a year, including the cost of air time. Just to recap, that's a real-time childbirth–child mortality system for a whole country, and it costs $5,200 and was implemented on dumb phones, using SMS, with community health workers. Now, the more we get that story out, the more people hear about it, the more people are going to basically be pushed into using this kind of stuff. I mean, donors will start to ask, 'Why are you not doing this?'"(Platform Interviewee)*

Other barriers mentioned by platform providers were similar to those mentioned by the online survey respondents described in the section below.

Results from Online Survey Respondents on the Barriers to Mobile Technology Adoption: A total of 173 of the 311 online survey respondents (55.6%) left a specific comment about barriers to adoption of mobile technology. The results from post-coding the survey responses yielded the finding that there are two major barriers to adoption of mobile technology in M&E systems.

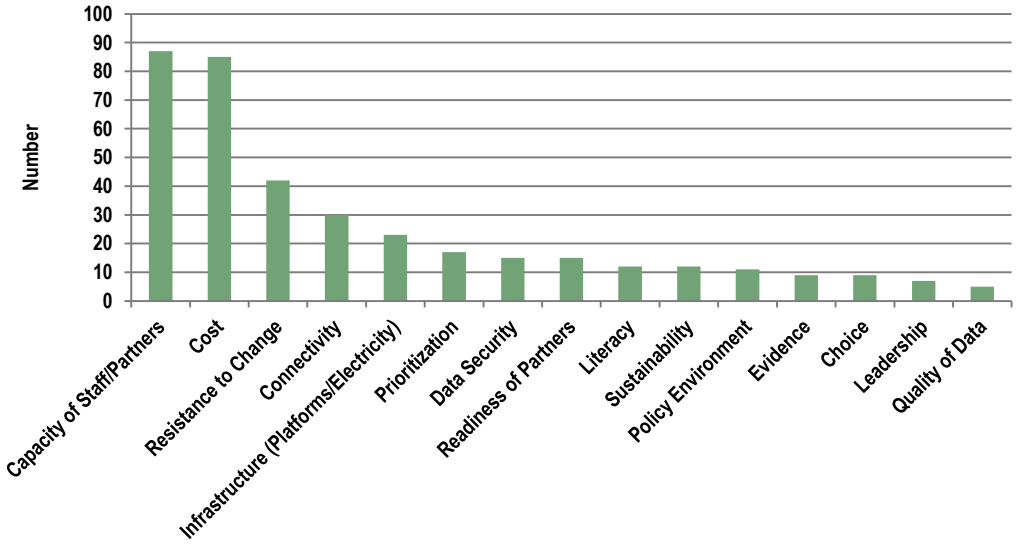
First was staff capacity to implement the change. Both US-based staff and staff based elsewhere recognized that capacity had not yet been built sufficiently to make adopting mobile technology seamless.

Cost followed closely as a major perceived barrier. Online survey respondents struggled to understand how to retrofit mobile technology into existing systems and ongoing projects in a resource-constrained world and were unsure of the actual costs that might be incurred by switching (and of the possible cost–benefits for converting).

Overall resistance to change was the third most frequently noted barrier. Online survey respondents mentioned it not only in reference to internal processes but also because of the need to get partners and communities on board with the change.

Connectivity (specifically, mobile connections) and infrastructure (specifically, electrical power and availability of platform providers with the right fit) were the fourth and fifth most commonly referenced barriers (Figure 17).

Figure 17—Barriers to Adoption of Mobile Technology



In the case of barriers to the adoption of mobile technology, there was consensus of opinion among all online survey respondents, regardless of where they were based.

Another online survey respondent summarized a different view of the major barriers:

> *"Lack of capacity. Lack of time to add another new or different way of doing something. Being unsure of the best way or best tool in the long run—something that will go beyond a program or project and be sustainable afterwards and not die with the end of funding, and finding ways to link with long-term systems. Ensuring data privacy and protection. Knowing how to get started. Knowing what tools are best for our purposes. Finding local partners to support in this area." (Online Survey Respondent)*

CHAPTER 5
DISCUSSION

This study used a diffusion of innovation framework to look at the question, "How are INGOs adopting the innovation of mobile technology into M&E systems for health care programs in international settings, and what factors are facilitating or inhibiting this innovation?" Specifically, the research sought to understand whether INGOs are allowing ad hoc adoption of mobile technology or are guided by a formal strategy and whether INGOs have met the prerequisites for organizational readiness for adoption of the innovation of mobile technology. The answers were sought in key informant interviews with INGO directors and platform providers and an online survey of more than 300 INGO employees from around the globe. This chapter will begin by discussing the results of the research, using the DOI framework and will conclude by discussing the limitations of the research findings.

Overall, the INGO community is showing high levels of readiness for change. The conditions of tension for change, innovation–system fit, and support and advocacy, are present—that is, the innovation is a good fit with existing systems; there is a demand for timelier, better quality data; and management support for the innovation IS high. Yet the wholesale adoption of mobile technology into M&E systems has not occurred.

The failure to adopt could be because of the relative weakness, highlighted by the research, of two other conditions for change—the ability to assess the implications of adopting the technology into M&E systems and dedication of time and resources to the adoption of mobile technology as an innovation for M&E systems.

The DOI framework results of the research were consistent with metrics for organizational readiness for change, where commitment to change and change efficacy were high, but both resource ability and task knowledge (i.e., how the change can be operationalized) were relatively lower. In-depth discussion for each section of the framework follows.

Discussion: Tension for Change

Overall, the high levels of agreement from all research participants that mobile technology would make their M&E systems more efficient and more effective reveal strong tension for change within the INGO community. A lesser number of respondents, but still a majority, agreed that mobile technology would also make their M&E systems more cost-effective than their current systems, which, if true, should be a major driver for change. However, INGOs as organizations are not necessarily price sensitive—that is, they often face the "use it or lose it" phenomena described by a platform provider:

> *"Organizations that are not cost sensitive—and that would be many organizations within international development—those organizations, if you say you can either get the product to meet your need for $100,000 or 60% of the product you need for $5,000, they're going to pay the $100,000. They have no incentive to save money at all. And, if you're working for a UN agency or US government agency, you're not incentivized to save money, you're incentivized to spend money. You've got to use it or lose it—by the end of the fiscal year." (Platform Interviewee)*

In reality, it's not clear that system cost is the barrier to implementing mobile technology that INGOs seem to think it is. INGO staff may be using cost as an excuse not to implement systems. What does appear to be true, however, is that INGOs are having a difficult time developing a business case for introducing mobile technology into their M&E systems and demonstrating whether the technology really is more cost-effective. Until it is possible to assign a monetary value to more-rapid data acquisition or to the savings bypassed by the use of inefficient systems that provide low data quality and that do not use mobile technology, cost-effectiveness of the innovation will continue to be difficult to

judge. Although INGOs are outwardly convinced of the technology's utility and cost-effectiveness—especially INGOs that are further along the spectrum of adoption—evaluations of adoption have not yielded conclusive evidence to support belief in its cost-effectiveness. Cost-effectiveness research has not been the priority that getting the data, providing the service or even proving the utility of the technology have been.

Given the high levels of agreement that mobile technology would also improve data precision, data quality, and the use of data for decision making within organizations, it seems that the tension for change in the INGO community is at fairly high levels, which should serve as a major driver for adoption of mobile technology for M&E systems going forward.

Although most respondents felt that the risk of adopting mobile technology for M&E systems was nonexistent to low, there was more concern about the risks of adopting the technology among those based at headquarters than among those based in the field. Low levels of perceived risk in adopting mobile technology at the field level may lower resistance to change. Headquarters offices and US-based personnel might benefit from examining their own perceptions of risk, which are actually a barrier to widespread adoption of the technology.

Most online survey participants (55.9%) have a current project or data collection need for which mobile technology might be the best answer but is not currently being used. Still, significant pockets of the INGO population either haven't used mobile technology for M&E systems, are not planning to use it, or are not sure of their plans. The unmet need for the use of mobile technology is noteworthy, especially because those who have not used mobile technology or are not planning to use it comprise a sizeable proportion of respondents in the research. To encourage adoption, INGOs might be well served to conduct an assessment or audit of how they could or should be using mobile technology and to work to expose their staff to ways that mobile technology could be used for M&E systems.

Discussion: Innovation–System Fit

Although most INGO respondents felt that mobile technology was compatible with their existing systems, few INGOs are taking mobile technology to scale, and most appear to be testing different platforms to understand what will work for them. The inability of most INGOs to move to scale with mobile technology for M&E may be due to the still-sizeable proportion of INGO respondents who either have not tried mobile technology for M&E systems or are still not planning to try it. But there are also other factors. The old adage "seeing is believing" might be at play. A high number of research participants had seen colleagues in similar organizations using mobile technology, and more than half felt that the system was compatible with their own. However, INGO interviewees did not necessarily view mobile technology as a panacea, and the data showed those who had not used the technology or were not planning to use it during the next year as still largely undecided about whether it might be worth introducing. The staff who still did not know about mobile technology, at all levels, are indecisive and not willing to take action at this time. Going forward, the INGO community's continued exposure to information about mobile technology and to lessons learned from successes and failures will be crucial to its adoption for M&E systems.

The platform organizations themselves have more work to do to get INGOs on board. Overall, a third of online survey respondents were still undecided whether platforms' features sufficed for their needs in M&E systems. More than a third were unsure as to whether platforms' training materials were sufficient. Many platforms require substantial consulting support to set up and introduce, and even then might provide only part of the solution to an INGO's needs. Given the proliferation of platforms today, it seems prudent for an organization to test several, pick the ones that best suit organizational needs, and work with those platforms to customize an approach. The importance of this trial-and-error

process will likely continue until organizations become more comfortable with mobile technology and are more conversant in its use.

However, it is inefficient for each organization to find its own way to the innovation and to build its own proprietary platforms and systems. If the INGO community is to make these platforms work better for their needs, it must engage with platform providers. But few individual INGOs can do this at the scale (and with the funding) that would be required to influence platform providers to provide systems for common use. Only if INGOs work together to build a few common systems across organizations and to persuade platform providers to address widespread needs (rather than the needs of individual organizations) will it be possible for the INGO community to move more quickly toward adoption of mobile technology for M&E systems. Given the competition for scarce donor resources, it is unlikely that INGO will work together with platform providers to address gaps and build common systems—a major step ahead. But such an initiative could easily be funded by donors, or required by donors, and would push INGOs into partnerships to move mobile technology for M&E systems forward.

Most INGOs have limited IT support for their programs, so platforms that require little support will suit their needs. However, not all platforms are intuitive. To speed the pace of adoption, it would be useful for more platforms to use a "Facebook" or "Gmail" approach, one that anyone can figure out (and that it is free up to a certain level).

To take mobile technology to scale within an organization, the consensus was that there needed to be some sort of central support or coordination from the organizational center, even in decentralized organizations, to facilitate the sharing of information and experience, troubleshooting of problems, and consideration of options. An INGO's structure may affect its ability to scale up mobile technology: Without a central technical team or IT team supporting the move to mobile technology, extremely decentralized organizations may find it difficult to take advantage of learning that is centralized within the organization and to select a single platform. Currently, in decentralized organizations, each part of

the institution is following its own approach. However, if each is using its own data definitions and buying its own platform subscriptions, the efficiencies of sharing costs for platforms and the ability to build larger and more robust datasets are lost.

Mobile technology will not fix an organization's weak data architecture. Without a strong framework, the fractured data "islands" of current projects will remain in place and perhaps be reinforced. Indeed, the need for rigorous thinking in order to understand data connections and linkages—essential to successful integration of mobile technology—may be the biggest barrier to its adoption for M&E systems. Traditional paper-based systems can be inefficient, and the inefficiency may pass without observation. But if data from a dataset generated by a new system can't be linked in meaningful ways, people will notice, and they may well lose faith in the technology or may question the quality of the M&E system itself. Introducing mobile technology provides INGOs with an opportunity to reflect on their data architecture—and improve upon it as needed.

Many respondents expressed the opinion exemplified by one INGO interviewee's remark that there are "not too many great examples of where we're fully harnessing that potential and really putting it to full use." Although research participants stated that mobile technology was a good fit for their needs and compatible with their systems, many concurred that the adoption process was very much a work in progress, far from being complete.

Discussion: How INGOs Have Assessed Mobile Technology's Implications

INGOs were weakest on this aspect of innovation adoption. Essentially, the idea is that organizations that set targets and evaluate themselves against those targets are much more likely to achieve adoption. Only 22.6% of online survey respondents reported having an organizational policy for the integration of mobile technology into M&E systems, and only 27.8% of respondents said they set targets to ensure the integration of mobile technology into M&E

systems. For the innovation to be on its way to full integration, according to the literature, higher levels of policy and target setting would be expected.

Similarly, only 33.1% of online survey respondents reported that their organization had conducted one or more evaluations of the utility of mobile technology for M&E systems. Overall, the level of evaluation of the implications of mobile technology was weak, and although research participants seemed to want more and better evidence of the usefulness of mobile technology for M&E systems (and for programming in general), the research showed that it is still not available. Tomlinson et al. called for donors to fund randomized controlled trials and for a robust and open platform for development of applications for mHealth to take proven applications to scale and thus to ensure their utilization,[19] but there is also a need for much more production of evidence around the efficacy of mobile technology, specifically for M&E. Although there is a repository for completed mHealth evaluations in the mHealth working group, there is no useful registry for ongoing mobile technology evaluations. A repository of protocols where other practitioners could look at evaluation designs, sampling strategies, and outcome measures, such as might be seen on the US government's clinical trials registry (www.clinicaltrials.gov), could help advance evaluation and eventually the production of evidence on mobile technology's usefulness. This registry would help network practitioners know whom to contact for evidence to support program needs.

Essentially, mobile technology is still being incorporated into the INGO setting in an organic way. If INGOs decide that adopting mobile technology for M&E systems in health programs is important to them, a more structured process, more cooperation, and systems thinking specifically to address data architecture will likely be needed.

Discussion: Support and Advocacy for Change

Support and advocacy within an organization play an extremely important role in the adoption of an innovation such as the use of mobile technology in M&E systems. INGO research participants reported high levels of management support for this innovation; this support will likely drive adoption. Executive champions within organizations played an important role in sending the message that mobile technology adoption was a direction worth following, organizationally. Effective champions in INGOs matched the characteristics described by Goodman and Steckler[97] in Rogers in that they:

- Occupied a key linking position in their organization.
- Possessed analytical and intuitive skills in understanding various individuals' aspirations.
- Demonstrated well-honed interpersonal and negotiating skills in working with other people in their organization.[79(p.415)]

Research participants reported that within their organizations that there were specific people, the so-called boundary spanners, providing links to different parts of the organization and to resources outside the organization. The literature calls such linking people critical to adoption of innovations, helping the innovations to become nested within the institution, both internally and externally. Although research participants report more supporters than detractors overall, the majority was not overwhelming.

Mobile technology is generally well integrated and spread throughout the organizations of most research participants, but M&E departments are most commonly responsible for its introduction. In organizations that have integrated mobile technology more widely beyond the M&E and IT departments (i.e., into technical, program, and even finance and administration areas), adoption will likely happen more quickly, because mobile technology will be institutionalized as a "way of doing business" rather than as an approach particular to M&E.

Discussion: Dedicated Time and Resources

The area of time and human resources is a major pressure point that can be leveraged to effect change among INGOs wanting to speed adoption of mobile technology for M&E systems. Overall, the research revealed that most organizations had not yet made the same level of investment in mobile technology for M&E systems as they had for IT infrastructure. Only a few organizations had dedicated units or personnel working with mobile technology for M&E systems, and where those personnel did exist, they were rarely 100% dedicated to the broad integration of mobile technology for their institutional M&E systems, but instead held competing responsibilities for other projects or for other M&E activities.

The area of physical resource availability (phones, platforms, training materials, electrical power) was a concern among research participants. They did not know how to access resources to facilitate adoption of mobile technology for M&E systems and did not have the staffing structure (or even, perhaps, the staff skill sets) to roll out the innovation organizationally. What many organizations described as useful was a process of getting people started, with a small project to get them some hands-on experience with mobile technology as a way to help remove the barriers to innovation. A small data collection project can certainly move things forward while utilizing relatively low levels of human resources and infrastructure (i.e., with a free platform, a few phones, and a project). What many organizations are finding is that the real cost of mobile technology lies in training the staff.

Many INGOs are developing training materials for their staff, although these materials are seldom publicly available. There is an obvious need for orientation, skills building, and continued information sharing for change leaders who would like to see their organizations adopt mobile technology for M&E. Yet as of July 2013, although developing multiple sets of basic training materials is inefficient, only one training manual was publicly available.[98] More will need to be developed to meet the widening INGO

need. The development of training materials by each INGO is one more major, and duplicative, use of time and resources. Recognizing the need for mobile technology skill sets in technical staff and building expertise through training is important to ensure that the organizational message about mobile technology is consistent organization-wide. Costs for the development of training materials could be reduced by sharing.

To handle the issue of sustainability—a challenge inherent in the introduction of mobile technology systems—some thought on design and end-of-project continuation costs needs to precede system launch. Lack of forethought could have adverse consequences, as evidenced by the moratorium on all eHealth projects in Uganda while the government put policies and procedures into place.[99] Some research participants expressed the belief in the critical importance of ensuring a sustainable business model. Others called mobile technology just a tool, like a computer, requiring an investment to facilitate its use.

INGO interviewees were equally split on the role of donors in promoting mobile technology for M&E systems—some feeling donors had been key (especially agencies that were early beneficiaries of pilot money from the Gates Foundation). Platform interviewees generally did not believe that donors had played a major role, because donor requirements for use of mobile technology in projects would push adoption forward more quickly than it has been proceeding. In fact, donors have been silent on the "how" of program implementation and do not require any specific methods. Donors certainly could play a central role in the adoption of mobile technology for M&E systems or mHealth projects more broadly by funding training materials, training courses, making mobile technology a requirement in requests for proposals or applications, or funding INGOs to work together to build common systems. But the results of the research suggest they are not in a rush to do so.

Discussion: Organizational Readiness for Change

For the 10 organizations that had six or more respondents in the survey, means for change commitment (4.10 ± .06) for all respondents were higher than 4, indicating agreement with the construct statements around the need to implement mobile technology and the benefit of implementing mobile technology to program participants. Means for all other measures (change efficacy, task knowledge and resource availability) were below 4, but close to it, indicating that the community of INGOs assessed is organizationally ready to implement mobile technology for M&E in health programs.

Task knowledge and resource availability are key areas for growth in order to further the adoption of mobile technology for M&E systems. Skills building, assistance in developing systems, and helping people "know what to do" will be supported by initiatives to ensure that staff have the necessary skills and abilities. Studies of the adoption of communications and computer technologies during the 1980s and 1990s illustrate this point.[85,97,100–102] Considerable behavior change and learning needs to take place in order to fully implement a new system; such changes require time.

But if organizations are so ready to change, if they are so committed to change, why haven't they done so? Although levels of readiness for change are high, many factors in the change management process have not been addressed *(see* the discussion of facilitators and barriers in the next section, *below).* A change management process takes time, and resistance to change is inevitable when major procedural shifts are required (i.e., the need to rethink data-system architecture or how to use data that is newly available in real time). Fear of failure, of the system not working, of not delivering expected results may well constitute a major impediment to the change that the predominantly early adopters who participated in this research profess to be ready to make.

Discussion: Facilitators and Barriers to the Adoption of Mobile Technology

The research for this dissertation revealed clear facilitators and barriers to the adoption of mobile technology for M&E systems. Although it would seem to make sense to try to reinforce the facilitators and attempt to remove the barriers, the question would arise as to which particular barrier or facilitator to focus on. By looking at the other research results (especially those concerning organizational readiness for change), a pathway may be discerned.

First, country office and field level staff felt that basic practical steps such as training, IT/technical support, and funding were important to implementing mobile technology for M&E in their contexts. At the same time, the inverse of these same issues—capacity and cost—were perceived as major barriers. Building the skills of staff in the field (and at headquarters) will be important to any strategy to increase the use of mobile technology for M&E. Use of overhead funds or pursuing new funding will also be critical to making the use of mobile technology for M&E systems widespread and a fundamental way of doing business. For the adoption process to move forward, a consistent strategy (e.g., putting mobile technology costs into all new proposals where appropriate) needs to be in place.

Second, although staff commitment to change was shown to be the most important facilitator for US-based staff, all research participants felt that resistance to change would be a major barrier to the implementation of mobile technology for M&E systems. To be successful, INGOs wanting to move toward adoption of this innovation need to plan for and around a change management process, as nicely stated by one INGO interviewee:

> *"You have to build sponsorship, and you have to find the champions. By sponsorship, I mean up and down the line. If line management in an organization doesn't support you, it'd be very hard to do it from grassroots level. Change management has to be paid attention to." (INGO Interviewee)*

Third, US-based staff felt that the increasing need for real-time data was an important facilitator of change. The business case for this is felt more keenly at headquarters level than at field level. If there

is truly more demand for real-time or aggregated data, this need must be thoroughly communicated across organizations. The urgency of the need (if it is real) has be felt and understood at all levels in order for a change management process to move forward.[103]

Finally, all research participants agreed that continued limited connectivity and limited infrastructure remained a barrier. These barriers are waning with each passing month and as network coverage increases. In addition, several platform providers are targeting their development and their products to "un-connected" environments; if lack of connectivity is significant as a barrier, the availability of these products should create demand, and their use should spread. A consistent supply of electricity may remain an issue for a longer period, but device-charging services and solar supply shops are increasingly available in locations with poor power coverage.

There is an additional infrastructure barrier: too much choice among platforms. In the early days of the computer revolution, there were only a few word processing software applications; eventually Microsoft came to dominate the market. In the mobile technology platform sector, companies are still emerging and growing, and none has yet become a Microsoft. The abundance of choice is bewildering to organizations and staff, who are just starting to work in mobile technology; the differing pricing structures and features make it difficult for organizations to choose a provider that is a good fit. This situation is unlikely to go away for some time, although it may be ameliorated by training materials that help staff to sort through their options. One possible solution is for a donor to fund (or an organization to work with a provider to create) a clearinghouse of information for potential customers. This group could devise an algorithm comprising a series of questions (like a mortgage calculator) that will lead organizations to understand which platform might be right for them. This clearinghouse would give platforms wider exposure; a feedback section (as found on Amazon or eBay) could help INGOs make better-informed decisions about providers. Such a service would need to constant updating given the pace at which platforms are changing and the uses they are being put to, but if there were seed money

for an initiative like this—and if it were found to be useful—providers would likely pay a fee to be part of it.

The complexity of getting started, of knowing how to link data into a broader system, and of knowing how to feed back rapidly available data all present major changes to the ways that INGOs do business. INGOs are large organizations, and wholesale change in their modus operandi appears to take time. Mobile technology has to become more common and less novel in order for real institutional adoption to take place.

> *"I think as long as they rely on IT experts . . . to show how it's done, it will take quite a long time to actually have as big an impact [as] it can have. But if ordinary people within an organization take it upon themselves and say, 'Hey, I can do this. I can learn this technology. It's not so difficult. It's just like learning Facebook or any other piece of new software,' that will really spark a rapid shift from paper, for example, to mobile." (Platform Interviewee)*

Limitations of the Research

Key informant interviews provide in-depth information about a topic, but cannot help to quantify the magnitude of an issue being researched. Survey research provides quantification, but in quantification, the context and a more nuanced understanding of why something is happening are lost. In this research, qualitative methods were used to address such potential gaps. Although it can be difficult to blend the results of qualitative and quantitative methods in a coherent way, the combining of the two in this research has, hopefully, overcome the limitations of either method alone. Despite using a mixed-methods approach, there were still several limitations in the methods and results. Specifically, there were limitations because of the type of organization studied; limitations due to the narrow focus on M&E systems and mobile technology; self-selection bias, especially in the online research, a major limitation; limitations in the ability to correlate achievement in mobile technology and particular outcomes and to examine the size of an organization and its impact; and, finally, limitations affecting the ability to assess public health outcomes as a result of the adoption of this innovation. These limitations are discussed in more detail below.

Limitations in Type of Organization Studied: Only data from INGOs based in the United States were included for this study; no data were included for INGOs based in Europe or based in developing countries, or for international organizations (e.g., the United Nations, the World Bank), despite evidence of mobile technology use among these groups. Because the study used LinkedIn and e-mail for recruiting, many online survey respondents emerged from INGOs outside the United States, as well as respondents from governments, NGOs, and universities. Data from these respondents were not included in this analysis. The study was limited in this way because US-based INGOs share a major funder in USAID and other US government sources and are thus likely to face operating conditions that are similar from one to the next—conditions different than those affecting European and other international organizations.

Limitations in Programmatic Scope: In addition, the proposed study looked only at how mobile technology for data collection in health programs is being integrated into M&E systems, and did not attempt to gain any broader understanding how of mobile technology is being used to deliver health programming (although this topic is also of interest to those involved with INGOs). Furthermore, a number of other sectors are using mobile technologies (notably in the areas of governance and conflict), and if these sectors were to be included, further lessons could be learned to guide future research.

Although mobile technology for M&E systems was the specific focus of this research, not everyone sees mobile technology with purely an M&E focus. It is possible that many responses referenced mHealth projects more broadly and were not specifically discussing mobile technology for M&E systems.

Limitations Due to Selection of Research Participants: As mentioned in Chapter 3, Study Design and Methodology (page 25), although an attempt was made to include INGOs not extensively using mobile technology in the interview process, fewer numbers of these organizations responded or agreed

to participate. Thus, the real barriers to adoption of mobile technology as an innovation may be masked or muted.

There is a major limitation of the data from the online survey in the form of self-selection bias. It is entirely likely that most online survey respondents were those interested in mobile technology rather than those who are not interested. Many respondents to the survey dropped out after answering the questions on previous and intended use of mobile technology in the future when the survey started to ask questions about experience with platforms, indicating that respondents to this survey were most likely to know something about mobile technology. The results must be interpreted in this light.

Limitations of Correlations with Level of Adoption and Organizational Size: No attempt was made to gauge how far along or how successful organizations have been in adopting mobile technology for M&E relative to one another or to establish some sort of ranking of such organizations, although it might be useful in order to study the characteristics of the most successful organizations and understand what drove their success. It would also have been useful to look more closely at the relationship between organizational size (and relative wealth) and its rate of innovation, which Rogers[79] suggests may be highly correlated. All the organizations in the organizational readiness for change analysis above were "large"—a similarity that may explain the likeness of the responses and explain why a sufficient number of responses was able to be obtained.

Limitations in the Impact on Public Health: Other relevant questions that this research did not attempt to answer in depth concerned how the adoption of mobile technology for M&E programs in health might ultimately impact public health. If the assumption is that better real-time data for decision making is a good thing, then the potential impact on public health programs that should or do rely on information to make decisions is positive: Beneficiaries should have better outcomes. Also, with better data on beneficiary outcomes and better ability to use data for decision making in real time, mid-course

corrections, also leading to better outcomes for beneficiaries, should also be possible. But the evidence as to this relationship needs to be tested.

Conclusion

The full power of mobile technology, if adopted at the systems level, to change the way we think about monitoring and evaluation has not yet taken hold among INGOs. Within the community, it is still business as usual. Although more than 70% of online survey respondents have used mobile technology, only a little more than half (55.7%) reported using mobile technology in M&E systems—a substantial proportion but still far from a number indicating complete adoption. Mobile technology is already being implemented by early adopters (per this research)—what will it take for the remaining 44.3% to move forward?

A relatively high percentage of online survey participants were not sure whether they were planning to use mobile technology during the coming year—a figure that coincided with high rates of not knowing whether the technology was needed. Results from this research indicate that more information and more sharing of experiences are essential if mobile technology is to become a de facto part of M&E systems.

The high level of organizational readiness for change evidenced within the INGO community needs to be leveraged if change is to continue. Key facilitators need to be advanced (i.e., existence of training materials, technical support, and access to funding), and key barriers removed (i.e.., continued lack of capacity, unclear costs of moving to mobile technology, and the resistance to change).

Such changes, put together in a way that facilitates the adoption of mobile technology for M&E systems in health programs, may positively impact human lives. At the very least, adoption would improve the quality and availability of data that are collected and increase the potential for the mining of big data in order to understand whether INGO approaches are having the intended effect.

A new paradigm in the literature focuses on technological innovations' "disruptiveness"[104,105] and on the tendency of these disruptions to follow patterns that mainstream companies find difficult to predict and to be able to pivot to address before their business is destroyed.[iv] Will INGOs be affected by a "disruption" here? Will an innovation such as mobile technology prove to be an item that the nonprofit giants don't see as useful but that consumers want and that thus eventually becomes *the* way of doing business? The answers to these questions are so far unclear. Having a more comprehensive sample of organizations, representing organizations of varying sizes and with multiple respondents per organization, would have made the conclusions of this research stronger and could establish the documenting of a baseline against which to assess future INGO business models, both sustaining and radical, that might affect the nonprofit sector.

[iv] Examples of disruptive technologies include Voice Over Internet Protocol such as Skype versus wireless phones, and Netflix versus traditional cable.

CHAPTER 6
POLICY AND PROGRAM IMPLEMENTATION—THE PLAN FOR CHANGE

Mobile technology for monitoring and evaluation in health programming will continue to develop and will likely grow in the areas of interactive voice response and ever-greater possibilities for integration into existing data structures. This research revealed the state of the INGO community's readiness to adopt mobile technology and the barriers and facilitators for adoption. A major component of the survey and interview processes was to query respondents about facilitators and barriers to adoption of mobile technology for M&E in health programs. These results in conjunction with the overall research findings were used to develop a proposed plan for change.

Recommendations to INGOs for Each Stage of Adopting an Innovation

Rogers[79] describes the need to consider several aspects of the process of adopting an innovation in order to influence an organizations' pace of implementation. He states that implementation does not always necessarily follow from an organization's decision to adopt an innovation. Adoption is the "decision" to pursue an innovation, and "implementation" is the actual use of the innovation. In the case of mobile technologies for M&E systems, it is not even clear that all INGOs have made a specific decision on whether to adopt the technology. Rogers describes the five stages in the innovation process for organizations (Figure 18). In this document, Rogers' structure has been used to suggest what INGOs who want to incorporate that innovation could do at each stage of the innovation process to move forward with mobile technology for M&E.

Recommendations for Stage 1, Agenda Setting

The first stage of the innovation process, agenda setting, precedes a decision about whether to adopt an innovation, when an organization is still identifying a need for an innovation (or exploring potential solutions to a problem). Based on the research findings, in the agenda-setting stage, I suggest that INGOs look at the current strengths and weaknesses of the M&E systems—to determine whether the system is meeting their needs in terms of availability of data to make decisions about health programs and to evaluate the quality of the data they collect—and that they generally conduct an assessment of the performance gaps between their current and ideal situations. In the agenda-setting stage, a key point would be to examine the timeliness of data in the current M&E system and whether it is sufficient.

Platform providers and donors could also participate in the agenda-setting space. Platform providers would be well served by finding more and diverse forums to share the information about their platforms. Donors could play a major role in agenda setting by funding central hubs that provide information on platforms (because current donor-funded mechanisms shy away from "recommendations") or by requiring more near-real-time data for their reporting.

Recommendations for Stage 2, Matching

Matching is when the problem identified in the agenda-setting stage is paired with an innovation or solution. The research revealed that INGOs and platform providers perceive a high level of compatibility between INGO M&E systems (the problem) and mobile technology solutions (the innovation) but feel that full information on the options or potential uses is not available. At this stage, continuing to expose staff to available options should lead naturally to a selection. Among INGOs, we have seen matching with several different platform providers looking for a solution that will work for their organizations. At this key point, something like an information platform (suggested in Chapter 4; page 111) could play a role in helping to join INGOs with platform

providers. Donors could also play a role in developing central applications that all implementing partners are expected to use.

After matching, a decision to implement an innovation is eventually made. The process may not be entirely linear. Steps may be skipped, some staff may be brought on board only after a decision has been made, or mobile technology might be accepted as an organizational priority and only then are several steps taken to identify a gap. If an innovation fails to gain traction, an organization may go back to an earlier stage in the process and reassess its options. An organization generally decides to use or discard an innovation between the second stage, matching, and the next stage, restructuring/redefining.

Recommendations for Stage 3, Restructuring/Redefining

In this third stage, implementation begins, and the organization "owns" the innovation. The advice to INGOs at this point is twofold. In implementing mobile technology for M&E systems, to the extent possible, careful advance thought about the system architecture will be important. Forethought will help to avoid creating unconnected systems and service and to make the innovation centrally available and more accessible. Also at this stage, the innovation must be introduced to a wide cross-section of the organization, so that all can see how mobile technology for M&E would contribute and how it would benefit health programs. All offices should be encouraged to try an application and a cross-organizational learning and sharing platform, such as Jive, could be used to share experiences. Mobile technology might be viewed as what Rogers[79] calls a "radical" innovation, requiring central technical expertise at this stage.

Recommendations for Stage 4, Clarifying

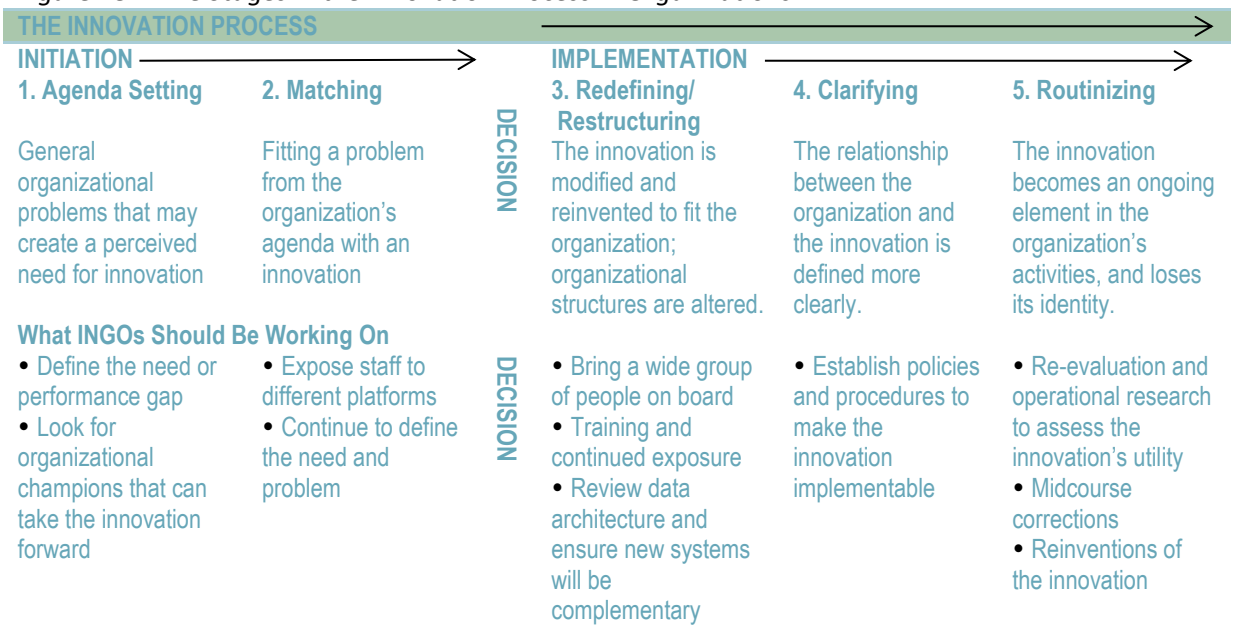
In the fourth stage in the innovation process, clarifying, the innovation is used more widely within the organization. The research revealed that several INGOs, having used mobile technology

for M&E, are in this stage but still not at the final stage (i.e., routinization). In the clarifying stage, INGOs must develop policies and procedures to support the ongoing use of mobile technology and to help staff see how mobile technology for M&E applies to them and how they can use it to improve their programs. Setting targets for achievement and integration of mobile technology will be important here.

Recommendations for Stage 5, Routinization

The final stage, routinization, is often talked about as "sustainability" or "institutionalization." In this stage, the adopters reinvent the innovation itself, and it becomes part of the system. A few INGOs have managed routinization for pieces of their organizational work but not yet for their M&E work for health programs in its entirety. Importantly, INGOs who have not yet begun research should do so, in order to track the utility of the innovation for their organization and to allow themselves to correct implementation if necessary.

Figure 18—Five Stages in the Innovation Process in Organizations



The Plan for Change

Overall, there appears to be agreement that adopting mobile technology into M&E systems in health programs will make them more efficient and most effective. I propose a six-prong strategy for helping INGOs adopt mobile technology into their M&E systems.

Dissemination of Research Findings

First, I plan to disseminate findings from this research, using Rogers' framework and the broader results through a research brief that summarizes the key findings from the research in a concise way coupled with a Webinar directly to respondents in the research who asked to receive results. The Webinar will focus on direct advice to INGOs (based on the research findings) as to what can be done if they want their organizations to adopt the technology. This list includes the tasks outlined in Figure 18 as well as:

- **Build consensus for change:** Within the organization, identify and target people who have not yet used mobile technology. These are the people with the weakest understanding and belief in its efficacy. To adopt mobile technology for M&E systems organizationally, this is the area to spend some extra time and resources. Don't neglect your early adopters, but be sure to bring along the fence-sitters.
- **Find areas for growth:** Within the organization's technical area, there may be more room for growth in some areas than in others. In the areas of orphans and vulnerable children, primary health care, health for human resources, capacity development, or emergency, water, sanitation, and hygiene areas, where there is low usage of mobile technology, there is room for growth. In other technical areas, there are likely good examples that organizations can learn from. They will want to seek these out.

- **Develop central technical expertise:** Even if the organization's structure is decentralized, central expertise is critical as people start off, as a resource that people know they can use to get help.
- **Develop basic training materials:** These should introduce the concept of mobile technology use within the organization, so that people can understand the possibilities, how others have used the technology, and how it can be applied within the organization.
- **Find an executive sponsor and/or an internal champion:** Strong leadership support and the ability to link different levels and units in the organization to one another is critical for introducing mobile technology.
- **Connect staff with the external community:** This includes people working in the field of mobile technology and with resources where they can find information (e.g., the mHealth working group, ICT4D, the mHealth Alliance, and M&E Web sites).
- **Think about the business case for mobile technology.** In addition, consider mobile technology's potential cost-effectiveness from the beginning. The sooner a case can be made, the more readily an organization (arguably, even one that is not cost sensitive) will move toward adoption.
- **Set targets and measure progress against them.** Although this was the weakest area of INGO performance, the literature shows it to be important in driving adoption.
- **Be prepared for the change management process.** It will not be simple or straightforward, and systems will have to change, bend, improve, and adapt to new ways of working.

Public Presentations of Findings

Second, I plan to present the findings at the mHealth working group (slated for fall 2013); at the American Evaluation Association meeting (AEA; October 2013); and at the ICT4D conference (tentatively scheduled for March 2014), where abstracts will be submitted at a later date. Sharing

this information with the survey respondent community and completing the feedback loop will be important to expanding the learning on mobile technology and M&E systems in health.

Publication Development

Third, I plan to develop publications on the research findings that will allow them to be disseminated to a wider audience. A preliminary list of possible papers from this dissertation research would include:

- Overall INGO community readiness for organizational change in the adoption of mobile technology for M&E systems.
- A case study of 10 organizations' readiness for change and the implications for organizations planning to adopt mobile technology for M&E systems in health.
- INGO readiness to adopt mobile technology using the DOI framework (i.e., tension for change, innovation–system fit, capacity to evaluate and assess the implications, time and dedicated resources, support and advocacy).
- A comparison of the INGO interviewee results with the platform interviewee results and an assessment of the synergies and differences among their statements.
- An in-depth look at the facilitators and barriers to the adoption of mobile technology for M&E in health programming.
- The pros and cons of using social media sites to recruit research participants.

Develop a Basic Startup and Orientation Training Package

Fourth, through my work at Pact, a basic orientation and a "how to get started" package is being developed, with mobile technology training materials, which we plan to disseminate through the BetterEvaluation.org Internet site, among other areas. These tools should provide a guide for organizations wishing to create or adapt their own materials for staff orientation. For many

organizations, the question of how to begin has been a stumbling block, and the Pact materials, ideally, will help fill the gap and build capacity in organizations that have not yet started, both at the INGO level and at the local NGO level—the more than 100 survey respondents who fit these criteria are evidence of a need in this cadre as well.

Give Platform Providers Exposure

Fifth, I plan to develop a Webinar for platform providers that will give them a chance to tell the INGO M&E community about their platforms and help to move people toward increased use. The idea would be to have platforms give a five-minute pitch about their platform and then link to other wider Webinars on another date that would go into more detail about their platforms and resolve individual INGOs' questions. The research findings will be shared with the platform providers who participated in the research and to others who may be interested in the way that they could work to improve their platforms for the INGO market. For platform providers, the data collected in this research—reaching beyond their usual ability to collect information—is a resource. Ideally, the changes and advances they make as a result of having this information will benefit the INGO community as well.

Provide Results to Donors

Sixth, donors will play a key role in facilitating the adoption of mobile technology into M&E systems. The preliminary findings from this research have already been shared with the Rockefeller Foundation, but major international donors such as USAID, the United Kingdom's Department for International Development, and other donors active in mobile technology applications, including the Gates Foundation, could all potentially benefit from understanding these results. Utilizing key contacts at each of these organizations and, through them, accessing other donors, I will share the research brief and inform donors of the research findings.

Repeat the Cross-Sectional Survey

Finally, in 2014–2015, I plan to work with Bryan Weiner to repeat the survey of INGO readiness for change to understand whether change is still occurring and how it is shifting over time. As noted in Chapter 5 (page 41), it will be important to make a concerted attempt to reach out to organizations that might be relatively smaller or in the earlier stages of adopting technology in order to understand how change is happening over time for a wider cross-section of the INGO community (Table 17).

Table 17—Proposed Timeline for the Plan for Change

ITEM	DATE
1. Disseminate findings through Webinar and research brief to research participants.	• September 2013 / October 2013
2. Presentations of findings to mHealth working group, at AEA conference, and at the ICT4D conference.	• Fall 2013: mHealth working group • October 2013: AEA conference • March 2014: ICT4D conference (pending submission and acceptance)
3. Develop and submit publications.	• September 2013–March 2015
4. "How to get started" with mobile technology training materials from Pact shared with INGO community.	• December 2013
5. Webinar with mobile technology platform providers to help provide more exposure on their platforms (and sharing of findings).	• December 2013
6. Provide the research brief and further information to donors	• November 2013
7. Repeat the survey	• After May 2014

Mobile phones are ubiquitous in developing countries and the promise of being able to use these assets to collect timelier, better quality data is an exciting development that could form an important basis for public health decision making in international health programming. Improved data for medical supplies and immunization logistics systems, near-real-time understanding of where TB case detection is and is not happening, and anthropometric measurements that could mean a timely nutrition intervention and get a child's life off to a good start are just a handful of the possible programs that could be improved by using mobile technology in M&E systems. What has not even been explored, because the data do not yet exist, is how sharing data across platforms and across agencies could make international health programming more targeted and more efficient.

An openly available dataset on a country's health centers, basic health statistics, water points, and the results of previous programs—in one site, in one format—would offer an opportunity for international aid agencies to plan additional evidence-based programming and to leverage basic information, rather than repeating costly (and unlinked) baseline surveys. The technology is being developed. It is up to the INGO community to embrace it and understand how to use it for the best in public health practice.

APPENDIX 1
INTERVIEW GUIDE FOR INGO DIRECTORS

Informed Consent

Before we get started with the interview, I would like to give you a little bit of background and ensure that we have covered the informed consent procedures.

My name is Kerry Bruce and I am a DrPH student at the University of North Carolina Gillings School of Global Public Health. This interview is for my DrPH dissertation study and is a research study. By way of disclosure, I am also the Director of Results and Measurement for Pact. The purpose of my research is to understand how U.S. based international NGOs are (or are not) incorporating mobile technologies into their monitoring and evaluation systems in health programs. I would like to understand the state of the field in 2013, the readiness of INGOs to adopt mobile technology into systems and the barriers and facilitators to adoption.

You have been selected for a key informant interview because you are either involved with mobile technology for your organization or involved with monitoring and evaluation. You are one of approximately ten (10) key informants that I will be interviewing.

This interview should take between 45-60 minutes depending on how much your organization has used mobile technology and where your organization is in the adoption process. Your responses in this interview will be used to frame and deepen the understanding of a separate quantitative survey of INGO staff that will be conducted shortly.

There are no foreseeable risks or discomforts to participating in this research. All answers will be reported at the aggregate level and no names of organizations or individuals will be used or stored with the transcripts for this interview. One possible benefit of participating in the research is that you may learn more about INGOs use of mobile technology in their monitoring and evaluation systems in health and you can receive an advance copy of the research findings.

Your participation in this research is voluntary and refusal to participate will involve no penalty or loss of benefits. You may discontinue your participation at any time.

Should you have any questions about this research you may contact Kerry Bruce (kdb@live.unc.edu) or Skype ID kerrybruce. You may also contact my faculty supervisor, Dr. John E. Paul at 919-966-7373 or john_paul@unc.edu. All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject you may contact, anonymously if you wish, the Institutional Review Board at 919-966-3113 or by email to IRB_subjects@unc.edu.

I will send you a copy of this informed consent form after our interview.

May I record this interview? I will be using the Sound Recorder or the MP3 Skype Recorder Program or the Windows to make recordings for transcription (Verbal Consent will be recorded).

Do you consent to participate in this research? (Verbal Consent will be recorded).

Key Informant Interview Questions and Script for INGOs

OK, let's get started.

First of all, thank you for being willing to speak with me about mobile technology and M&E.

1. I'd like to start by asking you, in your own words, could you please tell me if you are using or are planning to use mobile technology in your organization?
    a. Probe: What areas of health care programming are you using the technology?
    b. Probe: Which providers have you worked with?
    c. Probe: Is your use of technology specific to M&E or is it related to a different application (such as logistics or service delivery).
    d. Probe: How has your use of mobile technology been incorporated into your M&E system?
2. From your observation, is mobile phone technology starting to become more incorporated into M&E systems of INGOs and what is driving this?
    a. Probe: Is there an increasing need for real time / globally available data?
    b. Probe: How are staff across your organization incorporating the technology?
3. Do you see mobile phone technology systems as being compatible with your current systems?
    a. Probe: Do you think there will need to be a major overhaul of systems?
    b. Probe: What role do you think interoperability (moving between platforms with the same form) has in INGO uptake?
4. Have you conducted an internal assessment of the utility of mobile phones for M&E systems or have you developed a strategy paper that outlines your goals and plans for incorporating mobile technologies into systems?
5. Does your organization have either dedicated personnel time, resources, equipment or training that you are able to leverage to ensure that mobile technologies are being incorporated into M&E systems in health programs?
    a. Probe: Are these project funded or overhead funded?
    b. Probe: Are they continual or sporadic?
    c. Probe: How useful are these resources (if any) toward realizing the incorporation of mobile technology into your systems?
6. In your organization are there key leaders who are pushing for the incorporation of mobile phone technology into your systems?
    a. Probe: Who are they (what level)
    b. Probe: Do you have a champion of mobile technology at the executive level?
    c. Probe: Which actors appear to have the most impact?
    d. Probe: Are there leaders or actors from different departments who are supporting the incorporation of mobile phone technology into your systems?
7. Have you done any evaluations of your use of mobile technology in M&E systems?
    a. Probe: Have you set concrete goals and targets for incorporation of the technology?

8. In your observation of organizations (and you do not need to tell me the names), are there examples of INGOs that have successfully integrated mobile phone technology into their main M&E systems for health programs?
    a. Probe: What do you think made them successful?
    b. If no: Why do you think this is?
    c. Probe: What role did connections with outside actors play in their success?
9. Do you think that using mobile technologies will improve efficiency or impact in health programming?
    a. Probe: Why would a mobile M&E system in a health program be a benefit?
    b. Probe: How would use of mobile technology in M&E systems positively (or negatively affect health outcomes?)
10. So, in summary, what do you think have been the major factors that are working in your favor in terms of using mobile technology in your organization?
    a. Probe: What has the role of other actors, such as donors or thought leaders been?
11. What are the major barriers that are impeding the adoption of mobile technology into M&E systems of INGOs?
    a. Probe: Sustainability
12. That's it. Thank you for your participation. Is there anything else that you would like to add?
13. Would you like an advance copy of the findings when they are ready?

APPENDIX 2
ONLINE SURVEY DOCUMENT

1. The purpose of this research is to understand how international NGOs are incorporating mobile technologies into their monitoring and evaluation (M&E) systems in health programming. There are 35 questions. Most are multiple choice. Depending on how much your organization has used mobile technology and how much you want to tell me about the subject; this survey may take between 15-25 minutes. There are no foreseeable risks or discomforts to participating in this research. One possible benefit of participating in the research is that you can receive an advance copy of the findings and your voice and contribution may have an impact on how mobile technology is incorporated into M&E systems. All results will be reported at the aggregate level and NO NAMES OF ORGANIZATIONS will be used in the publicly disseminated findings. Results will be presented in such a way that there should be a minimum number of respondents at each level of reporting and it should not be possible to identify any respondent organizations or individuals. Your participation in this research is voluntary and refusal to participate will involve no penalty or loss of access to the findings. You may discontinue your participation at any time. This survey is one part of a research study that will be used for a DrPH dissertation. Should you have any questions about this research you may contact me Kerry Bruce (kdb@live.unc.edu) or Skype ID kerrybruce. You may also contact Dr. John E. Paul (Associate Professor, Health Policy and Management, Gillings School of Global Public Health) at +1 9199667373 or John_Paul@unc.edu. This research has been reviewed and approved by the Institutional Review Board at UNC, Chapel Hill. You may also contact them at +1 9199663113 or email IRB_subjects@unc.edu with any issues or concerns. Do you consent to participate in this research? (this is a required question)	1 Yes 2 No (if no skip to end)
2. What organization do you work for? If you do not see the name of your organization, please select Other and type the name in the Other response box. If you prefer not to responded, please select Choose Not to Respond at the bottom of the list. (This is a required question.)	(Pre-populated list)

3. Which office do you work for and what is your role? (Responses 1-2 answer questions for Track A questions.) (Responses 3-4 answer questions for Track B questions.) (Questionnaire remerges at Question 15)	1. HQ or Regional office – M&E 2. HQ or Regional Office – Not M&E (health, IT, programs, Management, etc…) 3. Country or Field Office – M&E 4. Country or Field Office
4. Mobile Technology Experience These questions are about your organization's previous experience with using mobile technology. For the purposes of this survey, the following definitions apply. Mobile technology: the use of mobile phones, tablets or personal digital assistants (PDAs). Mobile technology may encompass service delivery, data collection, logistics or the monitoring and evaluation of programs. Monitoring and Evaluation (M&E) systems: the broad system your organization uses to know that its programs are proceeding on target and achieving their goals (monitoring) and the systems you are using to collect information to measure your progress towards your goals and or your impact (evaluation). 4A. Has your organization ever used mobile technology to support M&E systems? 4B. Has your workplace ever used mobile technology to support your M&E systems?	1. Yes 2. No 3. Don't Know

5A. How convinced are you that using mobile technology would make your organization's M&E system…

5B. How convinced are you that using mobile technology would make your workplace's M&E system …

	VERY CONVINCED	CONVINCED	NEUTRAL	NOT VERY CONVINCED	NOT AT ALL CONVINCED	NOT SURE
More efficient?						
More Effective?						
More Cost Effective?						

6A. Does your organization intend to use mobile technology to collect data, provide services or support M&E systems in the next year? 6B. Does your workplace intend to use mobile technology to collect data, provide services or support your M&E system in the next year?	1. Yes 2. No 3. Don't Know

7A. What platforms has your organization ever used or tried? (check all that apply)
7B. What platform has your workplace ever used or tried? (check all that apply)

Have not used one yet	FieldCenter	mSwali
Acquee.com	FormHub	OpenDataKit
ChildCount+	FrontlineSMS	RapidSMS
DataWinners	iFormBuilder	TexttoChange
Dimagi – CommCare	Interactive Sales Solutions	ViewWorld
DoForms.com	Jana	Voxiva
eCollect	Magpi / Episurveyor	Other
EMIT	Mobenzi Researcher	
Other (please specify) _____		

8A. What program areas does your organization work in and in which areas have you used mobile technology? (check all that apply)

8B. What program areas do your project(s) work in and in which areas have you used mobile technology? (check all that apply)

	CURRENT PROGRAM AREA	MOBILE TECHNOLOGY USED
HIV /AIDS		
Health Financing		
Human Resources for Health		
Primary Health Care		
Maternal and Child Health		
Reproductive Health / Family Planning		
Infectious / Communicable Disease		
Non-Communicable Disease		
Neglected Tropical Diseases		
Emergency / Relief Health Care Services		
Nutrition Services		
Orphans and Vulnerable Children		
Pharmaceutical Support		
Supply Chain Management		
Social Marketing		
Health Information Systems		
Monitoring and Evaluation Systems		
Survey Data Collection		
Capacity Building / health System Strengthening		
Wash Sanitation and Hygiene Programs		
Non Health Area		
Other		

Other (please specify) _____

9A. For your organization's current project (s) that use mobile technology for M&E systems, does mobile technology…

9B. For your workplace's current project(s) that use mobile technology for M&E systems, does mobile technology…

	VERY FREQUENTLY	FREQUENTLY	OCCASIONALLY	RARELY	VERY RARELY	NEVER	NA
Improve the precision of health measurements?							

Contribute to better health outcomes for program beneficiaries							
Improve data quality?							
Lead to better use of data for decision making?							

10A. Do you think that the current mobile technology platforms have sufficient features and functions to meet the M&E systems needs for your organization? 10B. Do you think that the current mobile technology platforms have sufficient features and functions to meet the M&E systems needs for your workplace?	1. Yes, sufficient 2. No 3. Unsure / Undecided
What additional features or functions do you feel you need (please specify) _____	
11A. Do you think that mobile technology providers offer sufficient training materials to meet you organization's needs? 11B. Do you think that mobile technology providers offer sufficient training materials to meet your workplace needs?	1. Yes, sufficient 2. No 3. Unsure / Undecided
What additional training should they offer? (please specify) _____	
12A. Does your organization have a specific project or data collection need right now, where mobile technology might be the best answer, but is not being used? 12B. Does your workplace have a specific project or data collection need right now, where mobile technology might be the best answer, but is not being used?	1. Yes 2. No 3. Not Sure
If Yes, Specify _____	
13A. How does your organization perceive the risk of integrating mobile technology into M&E systems? 13B. How does your workplace perceive the risk of integrating mobile technology into M&E systems?	1. High Risk 2. Medium Risk 3. Low Risk 4. No Risk 5. Not Sure
What are the risks the organization might face? _____	
14A. Are mobile technologies compatible with your organization's current data collection and storage systems? 14B. Are mobile technologies compatible with your workplace's current data collection and storage systems?	1. Yes 2. No 3. Not Sure
15. Your organization Use of Mobile Technology In this section, I am looking for information about centralized actions your organization is taking to implement or adopt mobile technology. By organization I mean your entire organization, meaning all of your country offices, your field offices and your HQ office together. Does your overall organization have a written policy or strategy paper on the integration of mobile technology into your systems and practice?	1. Yes 2. No 3. Don't Know

16. Do staff at all levels in your organization understand how they might use mobile technology to improve their M&E systems?	1. Yes at all levels 2. Yes at most levels 3. No, most do not know 4. No I don't think anyone knows
Is there a specific level of staff that understands more than others? _____	

17. Readiness for Mobile Technology in M&E Systems[v]

Please select the response that best reflects what you think is your organizational position on the implementation of mobile technology into M&E systems.

In each question, "We" refers to your global organization. I am trying to understand the readiness of your entire global organization to implement mobile technology.

For example, We (as an organization) are committed to implementing mobile technology for M&E.

	DISAGREE	SOMEWHAT DISAGREE	NEITHER AGREE NOR DISAGREE	SOMEWHAT AGREE	AGREE
We know what steps are involved in implementing mobile technology for M&E systems					
We know what we need to do to implement mobile technology for M&E					
We know what resources we will need to implement mobile technology for M&E					
We can manage the politics of implementing mobile technology for M&E					
We can coordinate tasks so that implementation of mobile technology in M&E systems goes smoothly.					
We want to implement mobile technology for M&E.					
We are motivated to implement mobile technology for M&E					
We can keep the momentum going in implementing mobile technology for M&E					

[v] Note: The statements were randomized for each respondent to reduce missing data on specific questions and to avoid question bias.

We can support staff as they adjust to implementing mobile technology for M&E					
We believe that implementing mobile technology for M&E will benefit our systems and our beneficiaries					
We have the skills to implement mobile technology for M&E					
We need to implement mobile technology for M&E					
We are committed to implementing mobile technology for M&E					
We are determined to implement mobile technology for M&E					
We have the staff to implement mobile technology for M&E					
We can get staff invested in implementing mobile technology for M&E					
We can keep track of our progress of implementing mobile technology.					
We can handle the challenges that might arise in implementing mobile technology for M&E.					

18. From your perspective, how ready is your global organization to implement the use of mobile technology into M&E systems?	1. Not at all ready 2. A little ready 3. More ready than not ready 4. Ready 5. Very Ready
19. Are there people in your organization who help link you with others (ex: platform providers, technical assistance, training or other people or organization with experience) so you can use mobile technology in M&E systems?	1. Yes 2. No 3. Not Sure
If Yes, are the people from HQ or the Country Office who provide links? _____	
20. In your organization, are there more supporters or detractors for the inclusion of mobile technology into M&E systems?	1. More supporters 2. More detractors 3. About equal 4. Not sure

21. Which department(s) in your organization is/are involved in integrating mobile technology use into M&E systems (check all that apply)		
Monitoring and Evaluation Unit	Information Technology / Management Information System Unit	
Technical / Program Unit	Specific ICT Unit	
Country Offices as individual Units	Administrative / Financial Unit	
Leadership / Executive Team	Other _____	
22. Does your organization use either overhead or unrestricted funding (i.e. non-project specific funding) to support the use of mobile technology for M&E systems? If so, how? (check all that apply)		
Yes – dedicated personnel time	Yes –equipment (phones, tablets, chargers)	
Yes – subscriptions to provider services/ platforms	Yes – training	
Yes – help desks	Yes – discussion boards or working groups	
No – Nothing	Not sure	
23. Has your organization conducted any formal or informal evaluations of the use of mobile technology in M&E systems?		1. Yes, more than one evaluation 2. Yes, only one evaluation 3. No 4. Not sure
24. From your perspective, is the senior leadership of your organization supportive of using mobile technology for M&E systems?		1. Yes 2. No 3. Not Sure
25. Has your organization set specific targets for the inclusion of mobile technology into your M&E systems?		1. Yes 2. No 3. Not Sure
26. Have you observed that other organizations like yours are using mobile technology as part of their M&E systems?		1. Yes 2. No 3. Not Sure
27. Is gender a barrier to the adoption of mobile technologies into M&E systems?		1. Yes 2. No 3. Not Sure
Why? _____		
28. What role will data security play in your organization's adoption of mobile technology into your M&E systems?		1. Very important 2. Important 3. Moderately important 4. Of little importance 5. Unimportant 6. Not Applicable
What role will data security play in the adoption of mobile technology? _____		

29. What role have donors played in the adoption of mobile technology into your M&E systems?	1. Very important 2. Important 3. Moderately important 4. Of little importance 5. Unimportant 6. Not Applicable
Please explain _____	
30. What are the major barriers to integrating mobile technology into M&E systems in health programs? _____ _____	
31. What are the facilitators that will help people to integrate mobile technology into M&E systems in health programs? _____ _____	
32. What is your age?	1. <25 years old 2. 25-35 years old 3. 36-45 years old 4. 46-55 years old 5. 56-65 years old 6. >65 years old
33. Are you male or female?	1. Male 2. Female
34. What country are you based in?	(Drop down, pre-populated list)
35. Would you describe yourself as a person who likes to try new innovation or someone who likes to wait until the evidence is in before trying something?	1. I am always the first person to try new things, especially with technology. 2. I am sometimes the first person to try new things, especially with technology. 3. I am not usually the first person to try new things, I prefer to see the evidence of efficacy. 4. I definitely want to see the evidence before I try new things, especially with technology.
The survey is now complete. I appreciate the time you took to fill in this survey. Please feel free to forward the survey link to other INGO staff working in health programming. If you would like an advance copy of the findings from this research, please put your email address in the box below or send me an email at kdb@live.unc.edu. Your email address will not be linked with your responses and will be held in confidence. Email Address (optional) / Is there anything else you wish you could have told me? _____	

APPENDIX 3
INTERVIEW GUIDE FOR MOBILE PHONE TECHNOLOGY PROVIDERS

Informed Consent

Before we get started with the interview, I would like to give you a little bit of background and ensure that we have covered the informed consent procedures.

My name is Kerry Bruce and I am a DrPH student at the University of North Carolina Gillings School of Global Public Health. This interview is for my DrPH dissertation study and is a research study. By way of disclosure, I am also the Director of Results and Measurement for Pact. The purpose of my research is to understand how U.S. based international NGOs are (or are not) incorporating mobile technologies into their monitoring and evaluation systems in health programs. I would like to understand the state of the field in 2013, the readiness of INGOs to adopt mobile technology into systems and the barriers and facilitators to adoption.

You have been selected for a key informant interview because you are the Director of a mobile technology platform that works with INGOs. You are one of approximately eight key informants that I will be interviewing.

This interview should take between 45-60 minutes depending on how much your organization has worked with INGOs and how closely you have worked to help them develop their M&E systems. Your responses in this interview will be used to deepen the understanding of a separate quantitative survey of INGO staff that is currently being conducted.

There are no foreseeable risks or discomforts to participating in this research. All answers will be reported at the aggregate level and no names of companies or individuals will be used or stored with the transcripts for this interview. One possible benefit of participating in the research is that you may learn more about INGOs use of mobile technology in their monitoring and evaluation systems in health and you can receive an advance copy of the research findings.

Your participation in this research is voluntary and refusal to participate will involve no penalty or loss of benefits. You may discontinue your participation at any time.

Should you have any questions about this research you may contact Kerry Bruce (kdb@live.unc.edu) or Skype ID kerrybruce. You may also contact my faculty supervisor, Dr. John E. Paul at 919-966-7373 or john_paul@unc.edu. All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject you may contact, anonymously if you wish, the Institutional Review Board at 919-966-3113 or by email to IRB_subjects@unc.edu.

I will send you a copy of this informed consent form after our interview.

May I record this interview? I will be using the Sound Recorder or the MP3 Skype Recorder Program to make recordings for transcription (Verbal Consent will be recorded).

Do you consent to participate in this research? (Verbal Consent will be recorded).

Key Informant Interview Questions and Script for Platform Providers

First of all, thank you for offering to speak with me about your platform and your interaction with INGOs and how they are using mobile phone technology

1. Can we start by having you provide a little bit of background on your company, when it was formed and how you have worked with INGOs?
    a. Probe: How do you interact with your customers and encourage them to use your application in their systems?
2. From your observation, is mobile phone technology starting to become more incorporated into M&E systems of INGOs and why or why not?
    a. Probe: Is there an increasing need for real time / globally available data?
    b. Probe: How are INGOs incorporating the technology?
3. Do you see mobile phone technology systems as being compatible with current INGO systems?
    a. Probe: Do you think there will need to be a major overhaul of data systems?
4. How do you think interoperability has affected INGO uptake of mobile technology?
5. Have you participated in internal INGO assessments of the utility of mobile phones for M&E systems or have you helped them to develop strategy papers that outline their goals and plans for incorporating mobile technologies into systems?
6. Are you being funded by INGO partners to think about how to incorporate mobile phone technology into their overall M&E systems?
    a. Probe: Do you know if this is project funded or overhead funded?
7. What is your observation of how INGOs are thinking about mobile phone technology in terms of systems such as an M&E system? Are most INGOs thinking about mobile technology for their systems or just for specific projects?
8. What role does organizational leadership play in the incorporation of mobile technology into M&E systems?
    a. Probe: What level are leaders who are pushing for mobile technology in the organizations you work with? Executive, Senior Management or field?
    b. Probe: Which actors appear to have the most impact?
    c. Probe: Are there leaders or actors from different departments/parts of the INGO who are supporting the incorporation of mobile phone technology?
9. What role have donors played in the incorporation of mobile technology into M&E systems?
10. Do you think that using mobile technologies will improve efficiency or impact in health programming?
    a. Probe: Why would a mobile M&E system in a health program be a benefit?
    b. Probe: How would use of mobile technology in M&E systems positively (or negatively affect health outcomes?)
11. Do you think that gender has a role to play in the adoption of mobile technology into M&E systems?
12. Do you think data security has a role to play in the adoption of mobile technology into M&E systems?
13. So, in summary, what do you think have been the major factors that are working in your favor in getting INGOs to use your system for their M&E needs?
    a. Probe: What has the role of other actors, such as donors or thought leaders been?
14. Conversely, what are the major barriers that are impeding the adoption of mobile phone technology into M&E systems of INGOs?
    a. Probe: Sustainability
15. That's it. Thank you for your participation. Is there anything else that you would like to add?

APPENDIX 4
ADDITIONAL SURVEY RESULTS

Table A—Type of Health Sectors and Mobile Technology Use of the INGO Respondents – Full Table

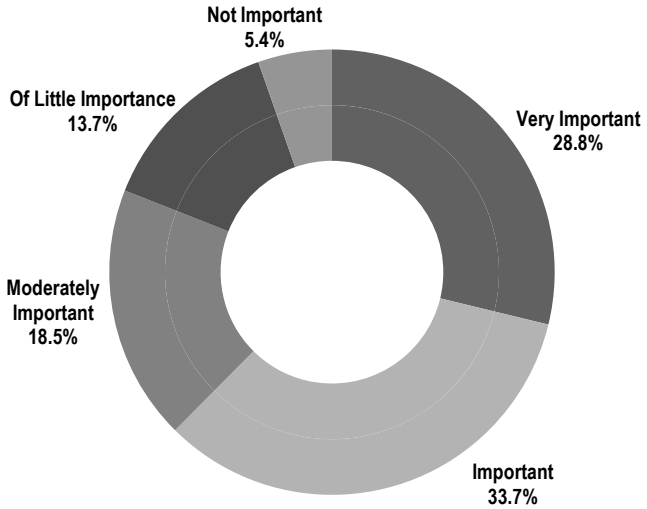
SECTOR	PERCENTAGE WHO REPORTED WORKING IN THIS SECTOR	PERCENTAGE WHO HAVE USED MOBILE TECHNOLOGY IN THIS SECTOR
Survey research	33.4	69.2
Supply chain management	14.1	63.6
Social marketing	9.0	60.7
Maternal and child health	43.1	56.7
M&E	39.9	55.6
HIV/AIDS	46.6	51.7
Reproductive health and family planning	30.5	46.3
Health information systems	21.2	45.5
Infectious and communicable disease	17.4	44.4
Non-health uses	11.6	44.4
Pharmaceutical support	6.1	42.1
Neglected tropical diseases	6.4	40.0
Nutrition	16.7	38.5
Orphans and vulnerable children	16.4	33.3
Primary health care	13.2	31.7
Water, sanitation, and hygiene	22.8	29.6
Health for human resources	12.5	26.5
Emergency and relief health care services	5.5	23.5
Capacity development	29.9	19.4
Mobile finance	8.0	16.0
Noncommunicable diseases	9.0	14.3

Table B—INGO Survey Respondent Previous Use of Platforms

PLATFORM	PERCENTAGE THAT HAVE TRIED THIS PLATFORM	TRIED ONLY THIS PLATFORM	TRIED THIS PLATFORM AND 1 OTHER	TRIED THIS PLATFORM "AND 2 OTHERS	TRIED THIS PLATFORM AND 3+ OTHERS
Acquee.com	0.8 (2)	-	-	-	100.0 (2)
ChildCount+	0.8 (2)	-	50.0 (1)	-	50.0 (1)
DataDroid	0.4 (1)	-	-	-	100.0 (1)
DataWinners	6.8 (18)	5.6 (1)	22.2 (4)	11.1 (2)	61.1 (11)
CommCare	12.1 (32)	3.1 (1)	12.5 (4)	25.0 (8)	59.4 (19)
Doforms.com	0.4 (1)	-	-	-	100.0 (1)
Ecollect	0.4 (1)	100.0 (1)	-	-	100.0 (1)
FieldCenter	0.4 (1)	100.0 (1)	-	-	-
Formhub	4.5 (12)	8.3 (1)	16.7 (2)	8.3 (1)	66.7 (8)
Frontline SMS	15.9 (42)	2.4 (1)	21.4 (9)	28.6 (12)	47.6 (20)
iFormbuilder	4.9 (13)	7.7 (1)	7.7 (1)	-	84.6 (11)
Interactive Sales Solutions Inc. (only IVR)	0.4 (1)	-	100.0 (1)	-	-
Jana	0.4 (1)	-	-	100.0 (1)	-
Magpi (formerly Episurveyor)	13.6 (36)	2.8 (1)	13.9 (5)	22.2 (8)	61.1 (22)
Mobenzi Research	5.7 (15)	6.7 (1)	46.7 (7)	20.0 (3)	26.7 (4)
Mobile Data Studio	1.1 (3)	33.3 (1)		33.3(1)	33.3(1)
OpenDataKit	9.5 (25)	4.0 (1)	20.0 (5)	20.0 (5)	56.0 (14)
PoiMapper	1.5 (4)	-	50.0 (2)	50.0 (2)	-
Rapid SMS	8.3 (22)	4.5 (1)	18.2 (4)	22.7 (5)	54.5 (12)
TexttoChange	1.5 (4)	-	-	25.0 (1)	75.0 (3)
Viewworld	0.8 (2)	-	-	-	100.0 (2)
Voxiva	4.5 (12)	8.3 (1)	16.7 (2)	33.3 (4)	-
Other[a]	5.3 (14)	14.3 (2)	35.7 (5)	7.1 (1)	42.9 (6)
Totals	n = 264	18.0	29.2	20.2	32.6

[a] ***Many platforms described as "other" were not actually platforms so much*** *as methods of data submission* ***(e.g., SMS). Also, many people responded that they did not know the name of the platform they had used.***

Figure A—The Role of Donors in the Future Adoption of Mobile Technology for M&E Systems



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