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GOLDBLOCKS DEEP DIVE

# A Mobile in Every Pocket: What Does it Mean for M&E?



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# Acknowledgments

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# A Mobile in Every Pocket: What does it mean for M&E?

*A mobile phone in every person's pocket will soon be a reality. What does this mean for development organizations? This report reviews the current state of mobile technology for survey and telephonic data collection, activity monitoring, and impact measurement. It also addresses the notion of crowdsourcing, and the various ways it is used to improve organizational decision-making.*

## Calling In, Calling Out

Shaukat Ali is a livestock technician posted to the Raiwind area in Lahore, Pakistan. Every day, he visits farms to treat sick animals and advise farmers on increasing their milk yields. His supervisor, Zubair Ahmed, sits at the district headquarters of the livestock department, managing the performance of over 100 technicians like Shaukat. Zubair himself is supervised by a district official, who is further supervised by a regional officer.<sup>1</sup>

Decision-makers like Zubair need data to effectively monitor and evaluate the performance of field staff and programs. Zubair typically receives two flows of data: one is from field workers like Shaukat, who collect data about farmers and yields through paper forms that are later mailed to headquarters and aggregated in Excel spreadsheets. This can be imagined as the organization's attempt at "calling out" to its customers for data. The other flow of data comes from farmers themselves, in the form of appreciation or complaint letters (e.g., incorrect billing for services). This represents customers "calling in" with data, or what is now commonly referred to as "crowdsourcing".

The ubiquity of mobile devices has dramatically influenced the way organizations "call out" to their customers, and the way that beneficiaries "call in". They have driven a profound shift in the availability, quality, and quantity of data accessible to service agencies, creating new channels for monitoring and evaluating service provision. This report highlights several examples of mobile-based data collection strategies in the development sector. It also describes future trends, and what they mean for NGOs in the age of 'Big Data'.

## Why Mobile?

Ten years ago, information and communication technologies (ICT) were still largely absent from the M&E toolkit. But the widespread adoption of mobile, network-connected devices has been transformative for the delivery of social services. It enables large-scale, two-way data loops linking service providers together with consumers throughout the world—even those in remote, hard-to-reach places. The opportunities for connecting have never been greater.

Still, most development evaluators have used mobile technologies in very conventional ways: to survey program recipients and beneficiaries. Surveys are traditionally conducted in person, through enumerators who interview program recipients and record responses using paper-based forms. These are brought back to the office for electronic data entry and analysis. This approach suffers from several challenges: paper surveys are bulky and difficult to transport to and from the field.

They are subject to enumerator errors as well as bias in the responses of those interviewed (including courtesy bias, recall or attention bias, and Hawthorne effects). Surveys must be digitized before any meaningful information can be drawn from them, which adds to operational costs and the risk of errors (especially for data entry done by hand). And it is difficult to change surveys once printed, even though conditions on the ground are likely to change over time.

In many ways, mobile telephony represents a new channel for survey research that is more aligned with the CART principles:

### **Credible**

*Collect high quality data and accurately analyze the data.*

Compared to paper surveys, technology-enabled surveys (also known as Computer Assisted Personal Interviewing, or CAPI) can produce higher-quality data. Automated data-entry checks can result in fewer errors and missing data.<sup>2</sup> In addition to text, rich content like pictures and videos or metadata like GPS coordinates and timestamps can be transmitted.<sup>3</sup> What's more, survey software can be used to improve enumerator performance, by automating the detection of fraud or data fabrication.<sup>4</sup> Of course using technology to monitor workers is nothing new: in the early 20<sup>th</sup> century, night watchmen carried clocks recording the time at which they visited different checkpoints, to prove to their superiors that they actually completed duty.<sup>5</sup> Smartphones have made these practices obsolete: enumerators can now walk around a land parcel to record the boundary coordinates electronically, or take a "selfie" (a self-taken photo) to confirm their presence at a particular location.<sup>6</sup>

Technology-enabled surveys have great potential to improve data quality. However, the data are only as good as their users. Organizations must take active steps to ask the right questions, apply the right analyses, and perform appropriate checks for data quality.

### **Actionable**

*Commit to act on the data you collect.*

Mobile data streams can deliver more timely insights than conventional survey data, because the results are available in (near) real-time, whenever there is network connectivity. It also became possible to collect high-frequency data using mobile devices, as will be discussed later. In addition, software can be built to rapidly aggregate, analyze, and visualize electronic data for quick use by decision-makers. When data are available in a timely fashion, they can inform short-term actions, not just long-term decisions.

### **Responsible**

*Ensure the benefits of data collection outweigh the costs.*

Traditional field surveys are costly and time consuming, requiring teams of surveyors to physically travel to the field and collect data. Conducting surveys by phone can reduce the field-based costs of data collection. Even when enumerators are sent to the field, surveys conducted using mobile technology may still cost less, because there is no need to print paper forms or digitize responses.

Remote phone-based surveying—through call centers, interactive voice response (IVR), or

messaging systems (USSD, SMS)—also offers improvements over paper-based surveying: it may lower staffing and transport costs, reduce the risks of reporting errors, shorten the timeframe between data collection and analysis, and can reduce operational costs. Numerous technology companies now offer mobile surveying services, and NGOs can benefit from a large array of options that can easily meet their data needs.

To the extent that mobile devices can be reduce costs, they become tools for promoting responsible M&E. But remember that all data have costs. Just because you can collect data cheaply does not necessarily mean that you should. For data collection to be responsible, the data must also be actionable and have a clear benefit to the organization and its stakeholders.

### **Transportable**

*Collect data that generate knowledge for other programs.*

Mobile technology makes it easier to use shared standards and protocols for data collection. This allows for the integration of data across program sites and organizations. Data become particularly “transportable” when data collection, analysis, and reporting adhere to shared protocols, many of which can be implemented using existing survey software. Comparing data across performance sites can help organizations identify inconsistencies, quickly correct problems, and learn from others.

### **Practical Considerations**

While mobile technologies can streamline and improve the quality of information about a program or service, it is not a substitute for good M&E practices. Technology makes it easier and faster to capture information about program performance, but instruments still need to be carefully designed, piloted, and revised. For any reliable conclusions to be drawn, data need to be cleaned and analyzed following rigorous methods. Similarly, although mobile data loops can be an improvement over paper-based surveying, they also introduce new challenges. These include selection bias, low response rates, and privacy concerns. Here, we discuss three channels for capturing data using mobile technologies:

1. Face-to-face interaction, in which enumerators use smartphones or tablets to collect survey data directly from respondents;
2. Over the air, which uses mobile devices to remotely survey beneficiaries or users; and
3. Crowdsourced or decentralized capture of information, using uncoordinated or directed contributions of data from local community members.

### **Face to face: Smartphone and tablet-based surveys**

Smartphones and tablets have become increasingly cheap and easy to use, making them convenient platforms for hosting a wide number of services and apps. It is no surprise that many organizations are now relying on these technologies to conduct surveys in the field. For instance, the International Livestock Research Institute is now using smartphones to survey goat farmers in Ethiopia.<sup>7</sup> The Nature Conservancy is shifting from paper surveys to tablets, to capture input from beneficiaries of its conservation projects in Africa.<sup>8</sup> Today, it is hard to find any medium to large NGO that has not at least experimented with mobile surveying.

In a smartphone or tablet-based survey, conventional paper forms are converted to a mobile application (usually via an existing data collection framework), which is loaded onto devices used by enumerators in the field. The filled forms are stored on the device in a tamper-proof format and transmitted to a central server, in real-time (if there is live connectivity) or as soon as the enumerator enters an area with mobile coverage. The data on the central server can be made rapidly available to decision makers in the form of online dashboards.

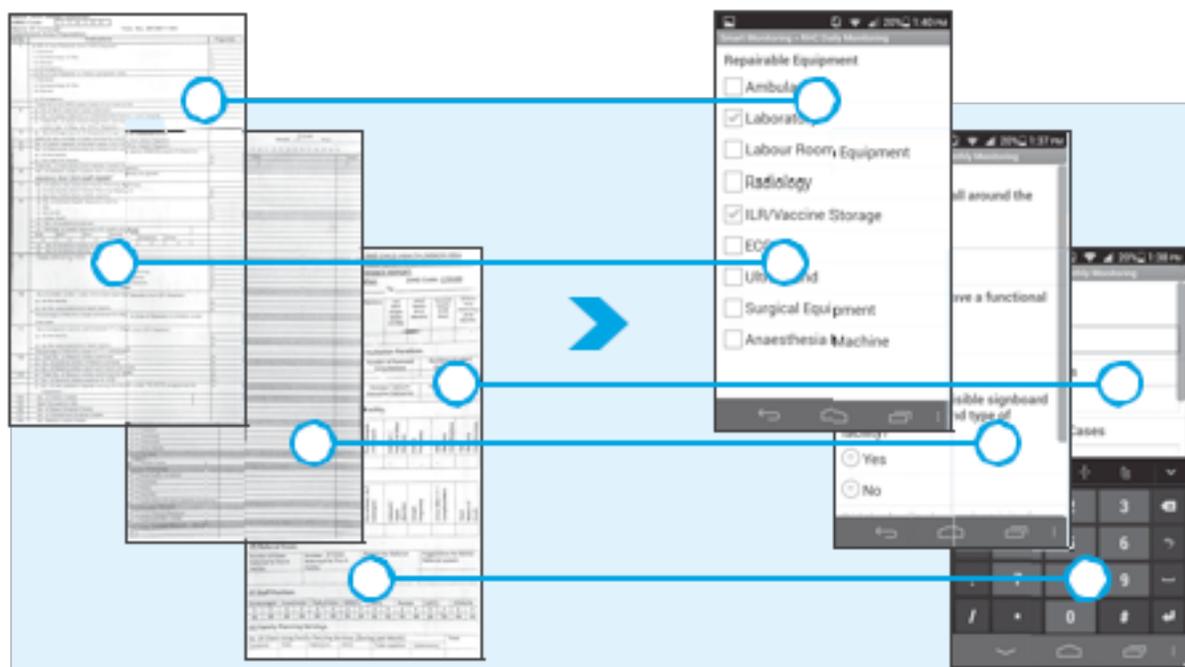


Figure 1: Conversion of Paper Forms into Smartphone-Based Forms using Open Data Kit.<sup>9</sup>

There are many mobile survey apps available in the market, for all major operating platforms (Android, iOS, Windows Mobile). The most popular include the *Open Data Kit*<sup>10</sup>, an open-source suite of mobile tools developed by software engineers at the University of Washington, and *Magpi*<sup>11</sup> (previously Episurveyor), a similar platform developed out of Nairobi, Kenya. Other options include *SurveyCTO*<sup>12</sup>, *iFormBuilder*<sup>13</sup>, *ViewWorld*<sup>14</sup>, *CommCare*<sup>15</sup>, *Akvo FLOW*<sup>16</sup>, *TaroWorks*<sup>17</sup>, *formhub*<sup>18</sup>, *EpiCollect*<sup>19</sup>, *KoBo Toolbox*<sup>20</sup>, *DataWinners*<sup>21</sup>, and *openXdata*<sup>22</sup>. Given the availability of detailed setup guides and a constantly growing number of user stories to learn from, setting up a mobile data collection framework for project surveying can be a fairly routine task. More flexible applications (like Blaise, SurveyBe, and Pendragon Forms) have been adopted by the research community, although these packages can be more costly to implement—both in terms of software licenses, and in terms of expertise required for programming and deployment.

The International Centre for Tax and Development offers concrete guidelines on the procurement of mobile devices, power requirements (when grid power is not available), application setup, staff training, and logistics.<sup>23</sup> Other groups like NOMAD,<sup>24</sup> MAMA,<sup>25,26</sup> and Kopernik<sup>27</sup> have developed online toolkits to help organizations choose the mobile framework that will best suit their needs.

Specialized data collection frameworks tailored to domain-specific applications also exist. One example is *Medic Mobile*, a platform used in the healthcare industry to register pregnancy, track disease outbreaks, keep stock of essential medicines, and communicate effectively in case of emergencies.<sup>28</sup>

The World Bank has developed a useful guide, entitled *“Logged On: Smart Government Solutions from South Asia”*, outlining major considerations when choosing a mobile survey provider.<sup>29</sup> Another useful resource is *“Mobile-Based Technology for Monitoring and Evaluation”*, a report from Fielddata.org, the Poverty Action Lab, and Innovations for Poverty Action. The report describes technology and software options, tips on choosing the right provider, how to procure devices, manage logistics, train enumerators, and ensure data security.<sup>30</sup>

## Challenges

Learning how to use a mobile device is not usually the biggest challenge for enumerators involved in smartphone or tablet-based surveying. Device screen size, on the other hand, can be a hurdle. Organizations often choose mobile phones with smaller screens to conduct surveys, as they are cheaper, lighter, and have longer battery life. The challenge of poor “real estate” can be addressed with tablets, which typically have 7” or 10” screens (18 to 25 cm). However, tablets come with their own logistical issues. They cannot be carried in a pocket or replace the enumerator’s own mobile phone and, hence, constitute an extra device to be carried out in the field. The risk of theft is also present, especially in areas where tablets are not common or are considered luxury items.

User interface is another challenge; many survey applications could improve the enumerator’s experience. It may be important for users to view questions in advance, move back-and-forth between questions, or record additional comments gathered from respondents. This can be difficult with some mobile-based survey packages.<sup>31</sup> It is valuable to pilot different software packages in the field before a full deployment—and learn from colleagues with similar survey operations—to ensure that the selected product or service will meet your needs.

## Over the air: Telephonic surveys and SMS

Have you ever received a call or text message from a telemarketer, asking about your internet provider preferences? Surveys do not necessarily have to be done in person. Just as in the private sector, NGOs and governments use call centers and short message services (SMS, USSD) to get in touch with program recipients.

In an initiative from the Pakistani government, citizens were called to comment via SMS on their experience with public service delivery. The data were then used to create dashboards with information on public perception of government programs.<sup>32</sup> A Ugandan NGO ran an SMS-based quiz to assess HIV/AIDS knowledge among a population of interest.<sup>33</sup> A World Bank project used a combination of SMS and frequent calls to collect feedback from community members on school teacher performance.<sup>34</sup>

For decades, outsourced call centers have been used for customer support, marketing, and market research. Today, these call centers are often located in developing countries and hire large numbers of calling agents. Call center services can be easily procured to run field surveys. Each questionnaire or script is considered a separate campaign with a defined target audience. Call center contracts can range from a single campaign run by shared calling agents over a short period of time, to a set of

campaigns run over an extended period run by dedicated calling agents. The agents are trained to follow scripts closely and are usually not permitted to deviate or engage in freeform conversation. Instead of outsourcing, organizations can also choose to set up their own call center by procuring an off-the-shelf solution.<sup>35</sup> This approach may be cost effective if the organization plans to use many different campaigns over short periods of time, which could require special expertise not readily available at existing call centers.

Like smartphones and tablets, call centers can reduce field travel costs and overcome some of the delays and data entry errors found in pen-and-paper surveying. Call center agents can call many people in a day and have richer conversations than might be possible with SMS or IVR. Call recipients can be reached, at least in theory, in any part of the world, as long as they have cellphone coverage. A 2001 study found that telephone-administered interviews allowed investigators to target specific population subsets (in this case elderly people) with surprising accuracy.<sup>36</sup>

Calls can be scheduled after typical work hours to increase response rates. A study conducted with US Army Veterans found that the optimal timing for a first call was weekday evening, with a 70 percent response rate.<sup>37</sup> Multiple calls can also be scheduled with the same recipients over time to maintain contact and build relationships. In the case of in-person interviews, this would entail repeated visits by the enumerator, which would be costly in time and money. Telephonic survey data can be captured at higher frequency, and then directly entered into an online form or a spreadsheet for rapid analysis.

In addition to conversations with calling agents, call centers can also send pre-recorded messages (often termed “robocalls”) or SMS messages. Increasingly, cloud-based technology firms are offering virtual call center services, using IVR rather than human call agents. With IVR, users can interact with an automated voice by pressing buttons on their keypad or through voice commands.<sup>38</sup> Platforms like *VOTO Mobile*,<sup>39</sup> *engageSPARK*, and *Twilio*<sup>40</sup> allow organizations to create and send recorded messages from anywhere, without any software installation or equipment requirements. Users can call in to record responses or their own voice messages, which may later be processed by human agents or through voice recognition engines.

*FrontlineSMS*<sup>41</sup> and *RapidSMS*<sup>42</sup> focus on SMS interactions with respondents, which can be used to run micro-campaigns (with very short questionnaires) or to nurture existing relationships. They are also used as an intervention, for example to send reminders or nudges to program participants. The advanced features of these services—including alerts to call center agents to schedule a follow-up call, or coordination of SMS and IVR campaigns with live call center support—may require some technical expertise. Organizations with complex needs might consider contracting or hiring qualified individuals in order to successfully deploy SMS or IVR campaigns at scale.<sup>43</sup>

## Challenges

Telephonic surveying comes with several challenges. First, phone conversations may be considered impersonal compared with face-to-face conversations. Call recipients usually take much longer to get comfortable speaking on the phone to an unknown agent, and it is more challenging for organizations to engage in meaningful conversations with users and recipients. The response rate for “cold calling”, a term commonly used in the sales profession, depends on a number of variables. Low response rates from a certain segment of the population may create *nonresponse bias*.<sup>44</sup> Similarly, because certain groups of people (e.g. women, youth, elderly) might not own or maintain a

mobile phone, there is a risk of *selection bias*, which results from nonrandom exclusion of potential observations from the population of interest. The increasing ubiquity of mobile technologies is reducing this issue, but organizations need to carefully evaluate the conclusions drawn from nonrandom samples.<sup>45</sup>

Second, field interviews usually involve small cash incentives or stipends paid to recipients in lieu of the time spent talking with the enumerator – an approach that can improve data quality.<sup>46</sup> Rewarding phone call respondents for their time has traditionally been more challenging, though the rapid growth of mobile money and cash-out for air time transfers is likely to address this problem.<sup>47</sup>

Finally, in some parts of the world people tend to change phone numbers very often, thereby erasing the only form of identification available to organizations. Mobile phone operators aggressively competing for market share in emerging economies often incentivize these behaviors. One work-around is to engage in random number dialing, using a quick screening questionnaire to identify whether the respondent is from an under-represented group. If so, a longer questionnaire can then be carried out.

### **Crowdsourcing and Decentralized Data Capture**

*Wired* magazine's Jeff Howe defines crowdsourcing as "the act of taking a task traditionally performed by a designated agent (such as an employee or a contractor) and outsourcing it by making an open call to an undefined but large group of people [...] Crowdsourcing allows the power of the crowd to accomplish tasks that were once the province of just a specialized few."<sup>48</sup>

Popular examples of crowdsourcing include *Wikipedia*, which sources knowledge, or *Kickstarter*, which sources funding for new ideas. Crowdsourcing differs from surveying in that beneficiary communities can become more actively involved in data collection and information gathering. A basic version of crowdsourcing used by organizations is toll-free numbers to collect consumer complaints. Mobile technologies have now expanded the array of crowdsourcing mechanisms, which can be divided into two categories: organization-led and citizen-led.

### **Organization-led (Directed) Data Capture**

Governments or NGOs often make calls for contributions of data, aimed at collecting information about a specific topic or generating feedback about an intervention. The call can focus on a particular group of beneficiaries (e.g., registered consumers or users of a service), use a network of hired observers, or be open to the public at large. Following a dengue fever epidemic in Pakistan, the government equipped 1,500 health workers with \$100 smartphones and asked them to take "before and after" photographs of their anti-dengue tasks and to upload images, tagged by location, so that they could be plotted on an online map, made available to the public.<sup>49</sup> The Government of Punjab in Pakistan is using smartphone-equipped monitors to report health worker absenteeism in rural clinics.<sup>50</sup> And USAID introduced "monitoring tasks" that the general public can objectively perform as a feedback mechanism for its development work in Afghanistan.<sup>51</sup>

This type of crowdsourcing is often referred to as "called for" because the organization has existing protocols for collecting and reporting information and pro-actively directs participants to contribute. Citizens usually respond to such campaigns because they may have something to gain individually (resolution of a personal issue) or are willing to contribute as a public good (to improve systems or

services over time). Others may contribute as paid agents. For example, the technology company Premise pays people around the world to log market prices for goods in their local stores. The data are used to generate “real-time” consumer price indices to track inflation and economic performance.<sup>52</sup> While most crowdsourcing initiatives typically assume that people have mobile phones available for data collection, groups or organizations can also provide affordable mobile devices to enable crowdsourcing.

### **Citizen-led**

Alternatively, individuals, groups of people, or third-party organizations can themselves make a public call for contributions of data on a particular topic. Unlike organization-led crowdsourcing, where resolution may be provided to those contributing, citizen-led crowdsourcing is often used to raise awareness about a specific issue. Urban dwellers in the US can use the online platform *SeeClickFix* to report neighborhood issues and push for authorities to fix them.<sup>53</sup> *I Paid A Bribe* is a website developed by the Indian NGO *Janagraaha*, where citizens can report cases of bribery they have experienced.<sup>54</sup> *HarassMap* is a similar platform allowing Egyptians to anonymously report cases of sexual harassment via SMS.<sup>55</sup> The information provided may be unstructured and is generally less directed. A UNDP report on “*Innovations in Monitoring and Evaluation Results*” provides more examples of these crowdsourcing initiatives.<sup>56</sup>

Crowdsourcing initiatives are not just limited to advocacy; they can also provide hyperlocal information and insights that are useful for program design. In the Congo, an illiterate community was equipped with rugged smartphones allowing them to share detailed environmental knowledge, as a way to combat poaching and improve the sustainable management of local forests.<sup>57</sup>

### **Implementation**

There is some overlap in the technologies used for mobile surveying and crowdsourcing. For example, a call center can be leveraged to run telephonic surveys, but it can also receive unsolicited feedback from program participants. However, most crowdsourcing platforms are supported by a website or app that is accessible from personal computers and mobile devices. An example is Twitter, which captures public data streams. The service offers “hash tags,” or labels, that can be distributed to an organizations stakeholders, allowing them to provide directed feedback. Twitter is designed to make crowdsourced data public, but custom platforms can be built to collect data for the exclusive use of the organization, without sharing publicly. Platforms can also be built to present data back to the public, either in raw form (in real-time), or as processed information and insights.

In most cases, organizations will want to set up a crowdsourcing platform by contracting an external consultant to design, pilot, and implement the system. There are a growing number of companies specializing in providing these services to non-profit organizations. These include *TextToChange*<sup>58</sup>, *Dimagi*<sup>59</sup> (the organization that produced CommCare and RapidSMS), *Social Impact Lab*<sup>60</sup> (creators of FrontlineSMS) or *DevResults*<sup>61</sup>. While their software solutions are usually open source and, hence, free to use, these organizations charge based on the length and complexity of the design and deployment. It is advisable to build internal technical capacity in-house if the intervention is going to be rolled out over a longer period of time, or cover a large number of beneficiaries.

### **Challenges**

There is a common gap in the feedback loop that is supposed to inform development programming; users and beneficiaries often want to share their insights about the success or failure of

interventions, but are unable to do so easily. Service organizations often are ill-equipped to capture unsolicited feedback on an ongoing basis. Instead, people may wait a year for a field agent to show up at their doorstep to ask for feedback. Crowdsourcing can address this issue.

A major advantage of crowdsourcing is to enable real-time monitoring of interventions. Instead of waiting for enumerators to carry out field visits, conduct surveys, and clean and analyze data, organizations can quickly spot any issues or problems in service delivery, and evaluate their performance on an ongoing basis. However, a challenge with crowdsourcing is false reporting. Misreporting is difficult to detect when the identity of the contributor is concealed, or when there is no barrier to entry. Ushahidi founder Ory Okolloh argues that while truth is never guaranteed with crowdsourcing, the idea is that with enough volume, a “satisfying truth” can emerge and diminish the risk of false reports.<sup>62</sup>

There is also the risk of over-quantifying information, sacrificing the nuances of qualitative data that can be difficult to capture through decentralized data capture.

## Conclusions

Today, mobile devices are widely used by NGOs to run survey campaigns, and they constitute a powerful platform on which numerous M&E applications can be built. Compared to their paper-based counterparts, electronic surveys tend to generate fewer errors, are cost-efficient, and produce actionable information more quickly. Cellular phones can be used to reach users and beneficiaries through call centers or via IVR and SMS, and they create opportunities to share thoughts and ideas through online crowdsourcing platforms. Deploying a successful ICT-based M&E campaign is not without challenges, but NGOs now have access to a wide array of technology providers and consultants to help in these efforts.

ICT is a fast-changing sector. As new technologies are developed, M&E practices will necessarily change over time. Projector smartphones will soon allow enumerators to play videos in the field, and share their screens with interviewees to increase trust.<sup>63</sup> Interactive survey platforms are beginning to support aggregation and visualization of community-level responses in real time, enabling enumerators to share results with respondents as data are collected.<sup>64</sup> Having surveys in digital formats also means that questions can be increasingly customized to suit respondents’ languages, preferences, and needs. As connectivity further improves, it will soon be possible to have expert surveyors located in call centers conducting video interviews remotely. Automatic speech and video recognition technologies will also allow non-verbal cues to be captured, for instance to gauge the respondents’ mood.<sup>65</sup> Researchers are also working on automatic quality control systems for mobile data collection, using machine learning to detect fraudulent data entry.<sup>66</sup>

As data are captured in higher volumes and richer formats, more complex analysis – establishing patterns across time, space, individual and exogenous factors – become possible. It will also be easier to automatically combine mobile data with other data sources, such as sensor networks and satellite imagery. The Internet of Things seeks to create seamless interactions among multiple devices—from mobile phones and beacons in shops, to point of sale terminals and in-home sensor systems.<sup>67</sup> Methods for identifying individual respondents is also changing, as we move from password-based approaches to biometric authentication. In this context, it is essential for organizations to track technology’s development, and support ongoing training for staff. Each year,

our daily lives and opinions become more measurable, creating new opportunities to rigorously monitor and measure impact in the field.



Photo: An enumerator interviews the supplier of a Kenyan Root Capital client.

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