Harnessing the Crowd to Improve Accountability for the Delivery of Public Services:
Pre-Analysis Plan for a Field Experiment in Kampala, Uganda

Mark T. Buntaine
University of California, Santa Barbara
buntaine@bren.ucsb.edu

Daniel L. Nielson
Brigham Young University
dan_nielson@byu.edu

3 November 2015

Project Summary

      This study aims to generate reliable evidence about the provision and quality of citizen monitoring of public services. Governments around the world are building platforms to collect information from citizens. As part of these programs, agencies increasingly seek to leverage mobile technologies to engage beneficiaries in monitoring at lower costs and with the potential to generate more useful data (Bertot et al. 2010; Rotberg & Aker 2013). Unfortunately, existing research — which tends to be conceptual or descriptive — has provided little guidance about whether mobile technologies can enhance public engagement with government by facilitating regular, high-quality, and useful feedback about the quality of public services. This experimental study of citizen monitoring of solid waste services is uniquely suited to answer foundational questions about citizen engagement with governments as mobile technologies become universally adopted. Because solid waste services are visible, we can verify the quality and timeliness of reports. We can also assess how citizen monitoring affects service delivery as part of a longer-term project. We are specifically interested in the following questions:

      Question 1 (Provision): Under what conditions will citizens voluntarily report information about public services? Some research has addressed volunteers' motivations to provide information online. A different literature targets citizens' inclinations to monitor governments and international organizations in traditional ways. Little research brings these literatures together to test how different incentives or recruitment methods drive participation in citizen monitoring.

      Question 2 (Quality): Under what conditions will information reported by citizens be timely, accurate, and frequent? Not much is known about the accuracy of information submitted by dispersed monitors or how different recruitment mechanisms influence the quality of information. It is not clear that information provided by citizen monitors provides a

representative sample of citizen demands or factual observations about the state of public services. For governments and donor organizations, the questionable accuracy and reliability of citizen-generated data dampens its usefulness. Few benchmarks exist against which officials might measure the accuracy, timeliness, frequency, and representativeness of information gathered from citizens.

Question 3 (Impact): Under what conditions will public services improve in response to citizen monitoring? Because public agencies do not have ways to assess whether citizen monitoring is accurate or representative, it is difficult to make plans, enforce contracts, and evaluate services on the basis of such data. For donor organizations and governments, it is difficult to know whether the reforms and improvements they promote might be made more sustainable by building citizen monitoring arrangements into projects.

Our study addresses these questions with a randomized control trial of citizen monitoring of solid waste services via mobile phones in Kampala, Uganda. Solid waste is a major challenge in Kampala, with a minority of waste produced in the city entering the formal waste stream (Kinobe et al. 2015). The Kampala Capital City Authority (KCCA) has prioritized improving solid waste management and improving resident satisfaction. International development organizations have recognized this critical issue and have provided years of support to upgrade services. In 2007, for example, the World Bank approved the $37 million Kampala Institutional and Infrastructure Development Project. This project, which was active until 2013, aimed to fundamentally transform the delivery of solid waste services by increasing the role of the private sector in collecting and processing waste across the city (World Bank 2007). Unfortunately, the completion report for this project shows that resident satisfaction in solid waste services has not increased (World Bank 2014). The World Bank is now planning follow-up projects aimed at improving the responsiveness of the Kampala Capital City Authority to citizen concerns. Questions have emerged about the ability of mobile technologies to enhance public engagement with government agencies and promote more accountable provision of public goods.

Relationship to past research

The idea that information technologies can facilitate citizen monitoring of public services has sparked cautious enthusiasm (Oates 2003; Grossman et al. 2014; McGuire 2006; Charalabdis et al. 2012; Linders 2012; Zurovac et al. 2012; Rotberg & Aker 2013). Many researchers recognize great potential for new information technologies to make implementing agencies more responsive to citizen demands, but they also identify significant political, operational, and data-processing challenges to employing spatial information sourced from non-representative groups of citizens into the delivery of public services (Ntaliani et al. 2008; Mossberger et al. 2013; Evans & Campos 2013).

While several prominent platforms have been established to generate citizen monitoring of public services in developed countries (e.g., SeeClickFix, FixMyStreet, NoiseTube), these

platforms are not designed to facilitate research about foundational questions of citizen-sourced data provision, quality, and impact. To this point the majority of research on citizen-sourced information deals with either disaster responses (e.g., Zook et al. 2010) or environmental monitoring (e.g., Connors et al. 2012). Neither issue deals with eliciting long-term improvements to public services. Scholars from fields as varied as information science, technology studies, political science, and public administration recognize that research about mobile citizen feedback requires more focused empirical research approaches (Linders 2012; Charalabdis et al. 2012; Saxton et al. 2013; Seltzer & Mahmoudi 2013).

Provision of citizen monitoring

Little systematic evidence is available about how to effectively recruit citizens to consistently monitor routine public services, especially in the countries where the quality of public services are very low. Citizens divide their attention across many diverse issues. Most existing instances where citizens send feedback with the goal of steering public sector activity have come about after disasters (Crooks & Wise 2013). In these contexts, it is easier to gain enough dispersed attention from citizens so that collective information is provided. Questions remain unanswered about whether citizens will consistently and accurately provide information about public services when there is no disaster heightening their attention.

Even more challenging, the population of individuals that provides data is limited by access to technology and propensity to communicate using certain technologies (Brabham 2009). Recent research has dealt with this challenge by investigating whether *crowdseeding*, in which researchers recruit representative samples of citizens and then compensate them for providing SMS-based feedback, can generate better and more consistent information than *crowdsourcing*, where participants self-select into providing monitoring information (van der Windt and Humphreys 2014). To this point no rigorous studies provide direct comparisons of the effectiveness of these recruitment methods and neither deals with the ability of local social networks to encourage engagement with government agencies.

Other studies have investigated the factors that promote participation in online platforms relevant to public affairs, including low participation costs (Grossman et al. 2014), perceptions of individual and collective benefits (Budhathoki & Haythornthwaite 2013; Chandler & Kapelner 2013), and opportunities for social connections (Brabham 2009; Blaschke et al. 2013). We have designed the study to overcome a key constraint that has limited existing research: reliance on self-reports from crowdsourcing participants about why they engage in crowdsourcing platforms (e.g., Brabham 2009; Brabham 2012; Seidel et al. 2013).

Quality of citizen monitoring

An even more fundamental challenge involves recruiting citizens to provide accurate,

timely, frequent, and representative information about public services. Citizen-reporting platforms in other contexts, such as environmental monitoring, have addressed the accuracy of amateur monitors (e.g., Bonter & Cooper 2012; See et al. 2014), the timeliness of citizen-sourced data (e.g., Munro 2013), and the representativeness of the data (e.g., McCormick 2012). While these studies identify problems of data quality involved with citizen science, they also find that dispersed reporters generate accurate data in many instances (See et al. 2014). Little evidence exists, however, about whether this finding applies to citizen monitoring of public services (Farina et al. 2014).

Citizen monitoring of public services is unique because participation is strategic. An open-access crowdsourcing platform that aggregates citizen comments might draw in participants who have incentives to portray public servants and officials in a negative light or to attract more attention from public agencies. We seek to address this challenge by studying a public service that can be independently monitored to serve as a benchmark, a parallel to recent work related to environmental monitoring (e.g., Comber et al. 2013; Fowler et al. 2013).

Data problems may also arise from concerns about bias. Those who are more likely to participate may have experiences with public services that are not representative of the population at large. For example, Weber et al. (2003) find that while the internet has broadened engagement of the public in U.S. political life, it has tended to reinforce policy positions biased towards more affluent segments of the population that experience better services. Brown et al. (2014) find that volunteer reporters who provide geographic data for public land management planning differ significantly from a representative sample of citizens in their policy preferences.

Other research finds that new forms of technology have been important to mobilizing the participation of segments of society that have tended to participate less in traditional public forums (Stanley and Weare 2004). Some high-quality experimental evidence from Uganda suggests that opportunities for citizens to participate by mobile phones in public life can "flatten" representation and promote participation by disadvantaged groups (Grossman et al. 2014), but a scale-up of a similar citizen engagement platform could not replicate the "flattening" effect of the smaller, controlled study (Grossman et al. 2015). The contradictory findings over representativeness are difficult to interpret in the case of public services without benchmark measures that might be used to understand how a sample of reports map to the actual state of public services.

Impacts of citizen monitoring

Results about the impacts of citizen monitoring of governments are also mixed. For example, Olken (2007) finds that citizen monitoring of road construction projects in Indonesia through public meetings did not reduce the amount of funds lost. Humphreys and Weinstein (2013) report that the public provision of scorecards on the performance of elected members of parliament in Uganda failed to change elected officials' public actions and had no effect on

citizens' voting behavior. Banerjee, Deaton, and Duflo (2004) find that the assignment of individual monitors to health facilities in India did not increase the attendance of health workers. And Banerjee et al. (2010) report that increased public participation in monitoring education services in India did not increase educational achievement. In all of these instances, monitoring alone was insufficient.

Other research suggests that monitoring can have an impact on the delivery of public services when it is tied to credible enforcement mechanisms. For example, Björkman and Svensson (2009) find that when a higher number of citizens formed a collective monitoring body for community health facilities in Uganda, they are able to increase the quality of services provided. In a follow-up paper (2010), they report that community fractionalization, which limits collective action, reduces the effects of this kind of citizen monitoring. Reinikka and Svensson (2011) find that a large-scale newspaper campaign in Uganda reporting how local units spend educational grants from the central government reduced money lost to corruption. The campaign created shared knowledge among citizens, which in turn promoted more collective and political action demanding high-quality services. While we will not test the impact of citizen monitoring in the pilot phase of the present study, we plan to continue following the impacts of the reporting platform over time.

Theory

This registration covers the first phase of our larger project and attempts to understand the provision and quality of citizen monitoring of public services. We are particularly interested in investigating how local social networks can improve the provision and quality of citizen engagement with government agencies. As such, we will compare how reporters recruited at random compare in their monitoring to reporters who are nominated by one of their fellow residents to report on behalf of local residents. We test whether nomination can make reporting more regular and accurate through two specific mechanisms. First, nominated reporters will be contacted based on a personal introduction of one of their neighbors. This may make them feel a greater social obligation to their community to accurately represent public services and identify problems. Second, nominated reporters are likely to be leaders within their communities and well-connected to other residents, which might enhance both their ability and willingness to report accurate information. While our experimental design will not allow us to parse out the social motivation versus selection mechanisms, we expect that both will operate to enhance the reporting performance of nominated reporters as compared to reporters recruited at random.

Existing research on referrals or nominations have mainly been studies in labor markets, rather than situations where individuals are asked to produce information that is useful for public administration. Studies of referrals in labor markets have found that referred employees exhibit lower quality than non-referred employees, potentially due to an incentive to trade favors within social networks with access to employment (Fafchamps et al. 2015). Experimental evidence

about referrals in Indian labor markets indicates that unless referrers are incentivized to provide high-quality referrals, they will likely nominate friends and relatives of lower quality who are in a better position to reciprocate materially (Beaman and Magruder 2012).

However, Christakis and Fowler (2010) find that the nominated friends of randomly selected individuals were better connected socially, so reports from the nominees allowed for significantly more accurate and earlier prediction of epidemics than reports from the random sample. However, citizen reporting on public services has not been studied across randomly selected and nominated individuals. Initial evidence from related experiments in Uganda suggest that social motivations can significantly elevate participation in SMS-based platforms that promote discussion of current events and public issues (Blaschke et al. 2013). In the context of public services, where public goods are likely to be maximized by choosing high-quality reporters who can effectively engage with government agencies, we expect that nomination will enhance the provision and quality of citizen reporting.

Background on study location and citizen reporting platform

Kampala, Uganda faces similar problems of monitoring and accountability for solid waste management as many other parts of the world (Bhuiyan 2010; Okot-Okumu and Nyenje 2011). With Kampala growing rapidly like many developing cities (Vermeiren et al. 2012), the need to improve the quality and scale of services is pressing. Private companies contracted to remove solid waste often provide services of lower quality to groups of people that are not able to share monitoring information (Oteng-Ababio et al. 2010; Katusiimeh et al. 2012). This places city managers in a challenging position, especially given information asymmetries, pressures toward corruption, and wealth disparities across communities.

The rapid proliferation of mobile phones in urban areas around the world may provide new pathways to citizen monitoring that allow better engagement with government and allow city managers to take advantage of the efficiencies that private providers can bring to services, as international development organizations have argued and promoted for decades (Cointreau 1994). We will randomly assign zones of the city to be monitored by citizens via mobile phones recruited using different methods, assess which recruitment methods produce the most useful information, and observe whether the monitoring improves solid waste services.

During the summers of 2013 and 2014, we completed preliminary research for the project and established the partnerships that will facilitate the proposed research. To scope out the relevance of our project to field conditions in Kampala, we embedded questions about satisfaction with solid waste services into a broader household survey. In total, we received responses from 439 individuals identified through a random walk pattern in randomly selected neighborhoods across Kampala. Initial survey data indicates that Kampala citizens are highly concerned about solid waste services in their communities. For brevity, we provide summary statistics about three questions: (1) personal concern about waste disposal; (2) dissatisfaction
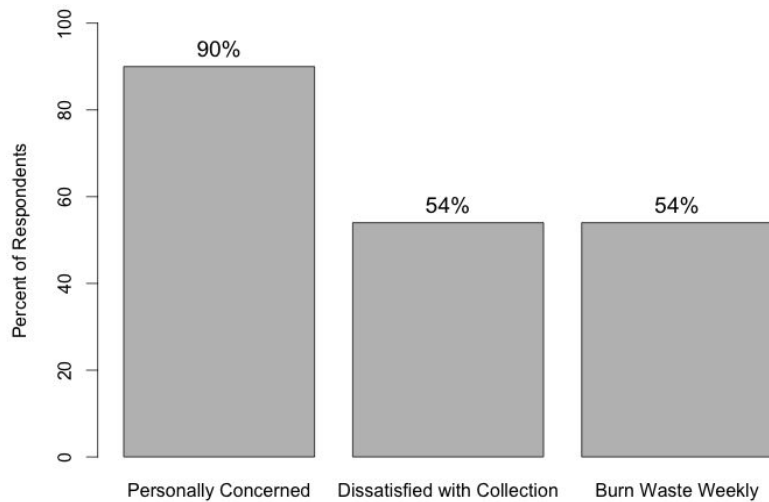
with current collection services; and (3) self-reports of burning waste at least one time per week. The vast majority of respondents are personally concerned with the state of solid waste collection and a majority are actively dissatisfied with the current state of solid waste services in their neighborhoods. Additional survey responses reveal that a minority of households are able to take advantage of formal waste collection services, and most households are forced to burn their trash on a weekly basis. Our survey data suggest that 86 percent of Kampala residents own mobile phones, so recruitment for monitoring can occur from the vast majority of residents in all zones of the city.

We are partnering with the Kampala Capital City Authority and using their official SMS shortcode to send weekly prompts asking citizens to report on solid waste conditions and services within their zones of residence. All SMS costs will be reimbursed to reporters and we will have a drawing for a ~$10 prize in airtime each week for all reporters who respond to the prompts. We will sign up reporters in-person using two different recruitment protocols and tag each mobile phone number in our study to a zone of residence. We will record the content and frequency of reports made by reporters under each of the recruitment protocols as outlined below. The procedures described in this registration are for a pilot phase of a broader project of citizen monitoring and reporting across Kampala.

Unit of randomization and randomization procedure

During October 2015, our implementing partner the Kampala Capital City Authority provided us with a list of all zones (LC I) inside the capital city jurisdiction of Kampala and the associated shapefiles outlining their boundaries. There are a total of 755 zones (LC I), contained within 97 parishes (LC III) and 5 divisions used to manage waste services. Our unit of treatment and randomization are individual zones. We will assign 45 zones to each of two treatment conditions using simple random assignment, for a total of 90 zones in our experimental sample.

Treatments

In each zone selected into this field experiment, we will attempt to recruit 12 reporters. After recruitment, these reporters will interact with the KCCA citizen reporting system in exactly

the same way. Each week they will receive prompts to report on the collection of solid waste, observations about waste fires, and areas within their zone that should receive attention from the KCCA or the collectors that are assigned to their zone. The only difference between the reporters is how they are recruited. All reporters in a single zone will either be recruited under a random sign up protocol or a nomination protocol (described in specific detail in Appendix A).

Sign up protocol. After finishing household surveys to understand the current state of citizen perceptions about solid waste services, as well as current practices used to dispose of solid waste, the enumeration team will approach at random adults walking or sitting outside of their homes and ask whether they will sign up to be a reporter.

Nomination protocol. After finishing household surveys, the enumeration team will approach at random adults walking or sitting outside of their homes. The enumerator will explain the platform and then ask the resident whether they can nominate a "trustworthy and responsible" individual who lives in the zone to report on solid waste services on behalf of the residents. If the individual would like to make a nomination, the enumerator will then ask that nominating individual to make a personal introduction to the nominated individual, either in person or by mobile phone. The team will then attempt to make contact with the nominated individual and request that they consider signing up as a reporter. We will record if the person nominated is the LC I chairperson and inform residents if he or she has already been nominated by a previous resident or nominee, with a request to make a different nomination. We will then ask the nominated individual to nominate another resident to be a reporter and continue using snowball nomination until an individual cannot nominate someone or we cannot make contact with the nominated individual. At that point, another random person will be approached to make a nomination.

Measurement of solid waste conditions

Household surveys. For each zone that is randomly selected into the experiment, we will identify 12 households to be included in a household survey through random spatial sampling based on a random starting point and random walk pattern (see Appendix A). We will ask respondents to show us up to five areas that their family uses for solid waste disposal, though we expect that most households will only use one or two locations. We will record time, direction and GPS-stamped photographs of the sites as pre-experimental baseline conditions, which we will use to measure change after the assignment to monitoring treatments in 6-8 weeks in this pilot phase, and then potentially again in later phases of the project yet to be designed. We will administer a short survey to an adult member of the same 12 households about satisfaction with solid waste services in the neighborhood and prevailing disposal practices (Appendix B). We piloted this survey during our preliminary field work to validate the questions. We will record

the mobile phone numbers and addresses of the survey respondents to enable a panel sampling effort in later phases of the project, though we will not have repeated contact with the survey respondents in the pilot phase covered by the current registration. The enumerators will use tablet computers and the KoboConnect app and the KoboToolbox data server to manage survey responses.

Random walk audits. In addition to household surveys, we will complete one hour of random walk audits in each zone of the sample (see Appendix A for procedures). As enumerators move along a random walk path, they will take a photograph and GPS reading for each waste heap greater than 1 meter in length or width that they encounter. The enumerators will continue this random walk for 15 minutes in each of roughly for zone quadrants or until they encounter 10 such heaps, whichever comes first. We will use the frequency of encountering such heaps as a measure of the baseline solid waste conditions in the experimental sample of zones.

Outcome measures and hypotheses

Provision of reporting

H1a: More nominated reporters will **respond to at least one prompt** than randomly recruited reporters.

H1b: Nominated reporters will **respond to more prompts** than randomly recruited reporters, measured as a count both over the entire 8-week experiment and within individual weeks.

H1c: Nominated reporters will **respond to more open-ended prompts** than randomly recruited reporters, measured as a count both over the entire 8-week experiment and within individual weeks.

H2: Of reporters who respond to at least one prompt in the first two weeks of the experiment, fewer nominated reporters will **discontinue reporting** than randomly recruited reporters, measured as a lack of reporting for at least two weeks that continues through the end of the 8-week experiment.

Quality of reporting

H3 (Accuracy)**:** Conditional on reporting, nominated reporters will **provide information that is closer to independent measures of the severity of solid waste problems** than randomly recruited reporters.

H4 (Representativeness)**:** Nominated reporters will **provide information indicating a larger variance of solid waste conditions** than randomly recruited reporters.

Estimation

Provision of reporting. Differences in means for the measures of reporting for H1-H2 will be estimated using randomization inference under the sharp null hypothesis assumption and an exact replication of our randomization procedure.

Quality of reporting. If a group of people reports the same objective conditions accurately, we will observe low variance of reported outcomes for the same objective conditions. We exploit this implication to estimate the accuracy of reporting through the KCCA platform. For each reporting outcome, we will divide the reporters according to their recruitment method. We will then run a nonparametric kernel regression with automatically chosen bandwidths to model the reporting outcome as a function of the objective outcomes measured during the baseline household surveys and audits. We will compare the mean squared error of the nominated reporters versus the randomly recruited reporters. We will then form a sampling distribution of difference in mean squared errors using randomization inference by repeatedly fitting such nonparametric models while exactly replicating our randomization procedure.

Power Analysis

We completed a basic power analysis to determine minimum detectable effects given our sample size. Due to budget constraints, we are able to recruit reporters from 90 zones. Because we seek to recruit 12 reporters per zone, we have a target pool of 1080 reporters. Our pre-test indicated that approximately 20% of randomly recruited reporters would respond to prompts in the first week. Based on this background rate, we explore the number of additional reporters that would need to have an individual-level treatment effect within the experimental sample to detect an average treatment effect with 80% power (see Figure 1). Our simulations indicate we will be able to detect an average treatment effect if 71 individuals whose potential outcome under the baseline treatment are not to perform the discrete behavior flip to performing the behavior under the alternative treatment. This means we can detect a difference between 20.0% and 26.6% of the experimental groups performing the target behavior.

Power analysis for discrete individual outcomes with zone-level cluster randomization

Number of additional individuals performing categorical behavior
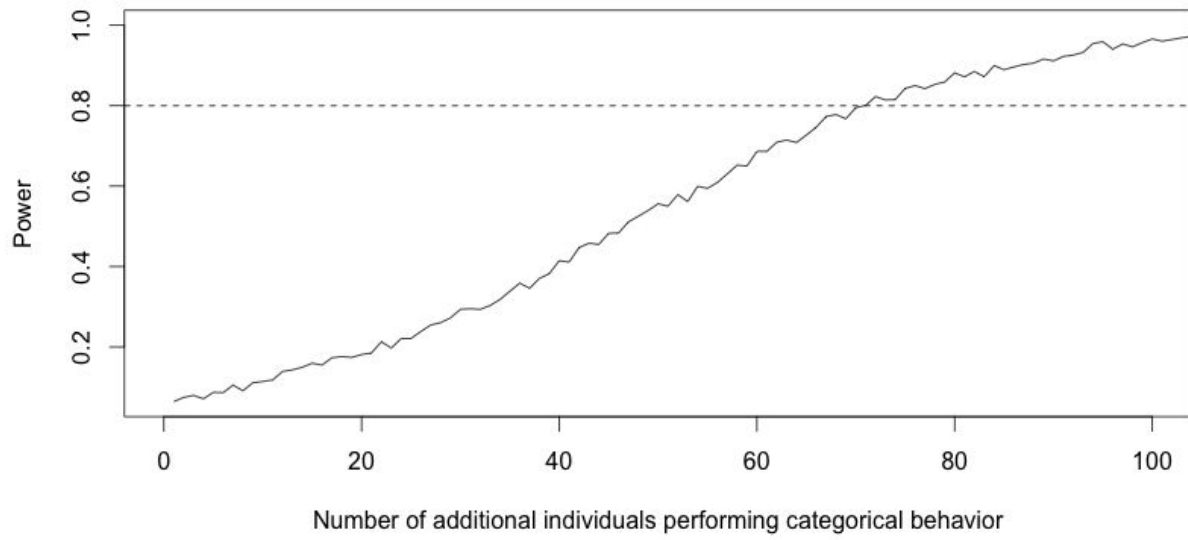
Appendix A: Baseline enumeration and audit protocols

Survey Enumeration

1. **Generate random walk pattern in the zone.**
   a. Each team of two enumerators asks a local resident to describe the boundaries of the zone and how to get to all of the boundaries. If a map of the zone is available, this step can be skipped.
   b. If possible, inform the LC1 or a member of the LC1 committee about the survey.
   c. Divide the zone up into roughly four cells. Each enumerator will be responsible for obtaining three interviews in each of the two grid cells they are assigned. This way all cells in one zone are enumerated.
   d. Find an intersection in each of assigned cells. An <u>intersection</u> is the crossing of any road, path, or alley that leads to the entrance of residential dwellings. The starting intersection should be located by walking several minutes into the assigned cell.
   e. Assign each direction leading from the intersection a number. Roll the dice and move in the direction selected randomly.
   f. Any time you reach another intersection, assign each direction that *moves forward* from your walk path a number and roll the dice, moving in the direction selected randomly. You should only turn around if you reach a dead end or the edge of the assigned cell.
   g. The only reason that the randomly chosen direction should not be an option is if you have already been down a path *and* you know that it leads to a dead end.
   h. Approach every fifth dwelling on the left during this walk pattern, until three interviews are obtained for the cell, for a total of 12 interviews per zone. Every fifth dwelling should be approached whether or not a resident is available. The GPS of the dwelling should be recorded the residence should be marked as "not available" or "refuse" if they are not present. Continue the random walk until you identify the fifth dwelling on your left, even if a respondent was not available or refused at the previous dwelling.
   i. If you reach the edge of the cell you are assigned or a dead end, turn around and continue the walk and interview pattern, again on the left side of the road as you move forward.

2. **Obtain electronic consent from respondent.** Enumerators read aloud the *entire* consent statement for the respondent in his or her preferred language and obtain signature providing consent using the tablet.

a. Enumerators should not place any pressure on the respondents to participate, including informally with body language.

b. The respondent is under no obligation to respond and may terminate the interview at any time without consequence, including loss of the participation fee.

c. The 1000 shilling participation fee should be immediately provided to the respondent *after* they sign the electronic consent form.

3. **Enumerate the survey.**

a. Enumerators should only interview adult residents of the randomly selected household. Maids or domestic help that do not live in the dwelling are not eligible to be respondents.

b. Enumerators read each question and response option entirely and without paraphrasing in the respondent's preferred language.

c. Enumerators enter the response option that most closely matches the respondent's answer, if it is not the exact wording given in the response options.

d. Enumerators will not offer commentary or help answering the questions. If the respondent cannot understand the question after repeated readings, enumerators will skip it and move on to the next question on the survey

e. At the end of the survey, respondents will be asked to show the enumerator up to five solid waste piles near their dwelling where members of their household deposit waste.

4. **Measure and photograph up to five waste piles used by the respondent's household.**

a. Waste piles may vary significantly in shape and density. It is important that each is measured accurately and according to consistent guidelines.

b. All measurement are taken by laying a tape measure next to the pile. Do not enter or touch the waste pile.

c. Take the measurement of width of the waste pile at the widest point from edge to edge. Enter this information on the tablet as survey indicates.

    i. The "edge" will be defined as: the outermost point at which the ground underneath the waste pile is not visible. While there may be trash scattered about around the waste pile, it is not included in the pile if ground can be seen between that trash and the greater waste pile. As soon as dirt or foliage is clearly seen, that is the edge of the pile.

d. Take the measurement of the length of the waste pile at the longest point from edge to edge (as defined above.) Enter the length on the tablet as before.

e. Geocode the waste pile as prompted by the survey instrument.

f. Other information for enumerators:

    i. Do not offer comments on the waste pile.

ii. Do not compare the waste pile to others you have seen or measured, even if asked by the respondent.

iii. Do not offer comments on the effectiveness of the KCCA, even if asked or prompted by the respondent.

iv. Be as exact as possible.

v. Do not put your health at risk to get the measurement. If you feel at any point that your health or safety is in direct risk by taking the measurement (or at any time in the survey process,) terminate the process without hesitation. Notify the project managers of your concerns.

vi. Be polite to respondents and grateful for their participation.

vii. Do not promise that participation in the survey in any way affects services provided by the KCCA, for better or for worse. The information will not be traceable by the KCCA, but will only help identify areas of the city in need of attention by the KCCA.

5. **Contingencies in measurement.**

a. If the waste pile has already been measured, please take another photograph, GPS location, measurement data, but mark "repeated pile" on the survey instrument.

b. If two waste piles appear distinct, with significant amount of continuous dirt or foliage between them, they will be measured as separate piles.

i. In this case, the edge that is conjoined to the second waste pile will be defined as the narrowest point where the two piles meet. The length or width of the waste pile will be measured from the conjoining edge to the outer edge as previously defined.

c. If the respondent does not know of any waste piles near their home, enumerators are to press the respondent to make sure that the lack of waste piles is a genuine situation. If it appears to be so, enumerators will follow the prompts on the survey instruments and enter "00" for the length and width for the variables to be dropped later. The respondent will still be compensated per the consent.

Note: the particular enumerators should be randomly assigned to zones each day

Frequently Asked Questions by Respondents

Q: Are you working for the KCCA?
A: We are an independent research team from the University of California. We are trying to understand how public services are delivered in Kampala. While we will share the general results of this study with the KCCA, we will never share individual data with the KCCA.

Q: Who is funding this research?

A: This research is funded by an organization called AidData, which aims to make information more actionable to improve development.

Q: How will we benefit from this study?
A: This study will be used to identify areas of Kampala where solid waste management needs to be improved. We cannot promise that the KCCA or other organizations will act on the recommendations that come out of this study, but we hope they will.

Observational Solid Waste Audit

1. **Based on the ending point of the survey enumeration in each of the four parts of the zone, restart the random walk.**
   a. The random walk is performed using the same procedure described in the enumeration procedures 1a-1g above.
   b. As you proceed along the random walk, take a photograph of all piles of waste visible from the walk path that are at least 1m in width or length using the "Observed Waste Piles" survey on KoboCollect, laying down the <u>1m measuring stick</u> as a point of reference.
   c. Continue the random walk while taking photographs until you have taken 10 photographs or used 15 minutes of time, whichever comes earlier.

Reporter Sign-Up

Reporter Sign-Up Protocol

1. After completing the solid waste audit, contact the first adult in sight.
   -To be eligible, the person must be an adult resident of the zone.

2. To ensure that the contact is eligible, ask if they're a resident of the zone.
   -If so, proceed to step 3.
   -If not, thank them for their time and repeat 1.

3. Explain the platform.
   -Hand them an information slip and answer any questions they raise.

4. Ask them if they'd be willing to participate as a reporter.

5. If yes, sign them up using the Sign-Up survey on KoboConnect.

6. After completing a sign-up, again randomly walk for 2-3 minutes. The random walk is performed using the same procedure described in the enumeration procedures 1a-1g above. Repeat the sign-up process beginning with step 1.

Reporter Nomination and Sign-Up Protocol

1. After completing the solid waste audit, contact the first adult in sight.
    -To be eligible, the person must be an adult resident of the zone.

2. Ask if they're a resident of the zone.
    -If so, proceed to step 3.
    -If not, thank them for their time and repeat 1.

3. Explain the platform.
    -Hand them an information slip and answer any questions they raise.

4. Ask them if they'd be willing to nominate a "reliable and trustworthy" person from the zone to become a reporter in the system.
    - Note that if the person wants to sign up themselves, we can do that, though we may or may not use the data that they provide. If this is the case, still ask them to make an introduction to another resident in the zone;

5. Ask the person to make a personal introduction to the nominee. Either by calling the person or by making a face-to-face introduction.

6. To ensure that the contact is eligible, ask if they're a resident of the zone.
    -If so, proceed to step 7.
    -If not, thank them for their time and repeat 1.

7. Explain the platform.
    -Hand them an information slip and answer any questions they raise.

8. Ask them if they'd be willing to participate as a reporter and remind them they have been nominated by a neighbor

9. If yes, sign them up using the Sign-Up survey on KoboConnect.

10. Ask the person if they would like to nominate anyone to be a reporter, regardless of whether they have signed up or not.

11. If no, again randomly walk for 2-3 minutes. The random walk is performed using the same procedure described in the enumeration procedures 1a-1g above. Repeat the sign-up process beginning with step 1.

Appendix B: Baseline survey instrument questions

- Enumerator name
- Age
- Interview location
- Respondent Available
- Zone of Residence
- Consent Signature
- First Name
- Gender
- Mobile Number
- How many people are living in your household?
- What is the highest level of education you have attained?
- What is the highest level of education that the female head of household has attained?
- What is your average monthly income?
- How many years have you lived in your current zone?
- How many years have you lived in Kampala?
- What is your employment status?
- How do you think the living conditions in your zone compare to the rest of Kampala?
- What is the main source of lighting in your household?
- Does every member of your household own at least one pair of shoes?
- Does your household own a radio?
- Do you own a mobile phone?
- How many members of your household own a mobile phone?
- How often do you take your rubbish to a KCCA dump site?
- How often do you take your rubbish to a KCCA rubbish truck?
- How often do you burn your rubbish?
- How often do you bury your rubbish?
- How often do you take your rubbish to an unofficial dump site?
- How often does a private company or private individual collect your rubbish?
- Are there any other ways you dispose of your rubbish that we have not already discussed? If yes, please describe the way you dispose rubbish.
- How often does the KCCA collect rubbish from the dump site you use most often?
- How often does a KCCA rubbish truck visit your zone?
- Have you had to pay money for rubbish collection services in the last 6 months?
- What prevents you from using KCCA dump sites or rubbish trucks as your only means of rubbish disposal?
- Other What prevents you from using KCCA dump sites or rubbish trucks as your only means of rubbish disposal?

- How satisfied are you with rubbish collection services in your zone?
- In your zone, how much of an issue is rubbish disposal and collection?
- Do you agree or disagree with the following statement: The collection of rubbish in my zone is important to my everyday life.

- Thank you for this information. To understand how solid waste is managed in your zone, we would now like to ask you to show us up to five places where members of your household have disposed rubbish in the last 30 days. We will measure and take photographs of these places, so that we can accurately represent the status of solid waste collection near your home. Remember, your responses are completely confidential and will only be used by our research team. We will not share your individual responses with anyone, including the KCCA.

References

Banerjee, A. V., Banerji, R., Duflo, E., Glennerster, R., & Khemani, S. 2010. Pitfalls of Participatory Programs: Evidence from a randomized evaluation in education in India. *American Economic Journal: Economic Policy*, 1-30.

Banerjee, A., Deaton, A., & Duflo, E. 2004. Health, health care, and economic development: wealth, health, and health services in rural Rajasthan. *The American economic review*, *94*(2): 326.

Beaman, L., & Magruder, J. (2012). Who gets the job referral? Evidence from a social networks experiment. *The American Economic Review*, 3574-3593.

Bertot, J. C., Jaeger, P. T., & Grimes, J. M. 2010. Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government Information Quarterly*, *27*(3): 264-271.

Bhuiyan, Shahjahan H. 2010. A Crisis in Governance: Urban Solid Waste Management in Bangladesh. *Habitat International* 34(1): 125-133.

Björkman, Martina and Jakob Svensson. 2009. Power to the People: Evidence from a Randomized Field Experiment on Community-Based Monitoring in Uganda. *Quarterly Journal of Economics* 124 (2): 735-69.

Björkman, M., & Svensson, J. 2010. When is community‐based monitoring effective? Evidence from a randomized experiment in primary health in Uganda. *Journal of the European Economic Association 8*(2‐3): 571-581.

Blaschke, Sean M., Peter P. Carroll, Daniela Rojas Chaves, Michael Findley, Madeleine C. Gleave, Robert N. Morello, and Daniel Nielson. 2013. Extrinsic, Intrinsic, and Social Incentives for Crowdsourcing Development Information in Uganda: A Field Experiment. Working Paper.

Bonter, D. N., & Cooper, C. B. 2012. Data validation in citizen science: a case study from Project FeederWatch. *Frontiers in Ecology and the Environment 10*(6): 305-307.

Brabham, D. C. 2009. Crowdsourcing the public participation process for planning projects. *Planning Theory*, *8*(3), 242-262.

Brabham, D. C. 2012. Motivations for participation in a crowdsourcing application to improve public engagement in transit planning. *Journal of Applied Communication Research*, *40*(3), 307-328.

Brown, G., Kelly, M., & Whitall, D. 2014. Which 'public'? Sampling effects in public participation GIS (PPGIS) and volunteered geographic information (VGI) systems for public lands management. *Journal of Environmental Planning and Management*, *57*(2), 190-214.

Budhathoki, N. R., & Haythornthwaite, C. 2013. Motivation for Open Collaboration Crowd and Community Models and the Case of OpenStreetMap. *American Behavioral Scientist 57*(5): 548-575.

Chandler, D., & Kapelner, A. 2013. Breaking monotony with meaning: Motivation in crowdsourcing markets. *Journal of Economic Behavior & Organization*.

Charalabidis, Y., Triantafillou, A., Karkaletsis, V., & Loukis, E. 2012. Public policy formulation through non moderated crowdsourcing in social media. In *Electronic Participation* (pp. 156-169). Springer Berlin Heidelberg.

Christakis, Nicholas A., and James H. Fowler. 2010. Social Network Sensors for Early Detection of Contagious Outbreaks. *PloS one* 5(9): e12948.

Cointreau-Levine, S. 1994. *Private Sector Participation in Municipal Solid Waste Services in Developing Countries*. Washington, D.C.: The World Bank.

Comber, A., See, L., Fritz, S., Van der Velde, M., Perger, C., & Foody, G. 2013. Using control data to determine the reliability of volunteered geographic information about land cover. *International Journal of Applied Earth Observation and Geoinformation*, *23*, 37-48.

Connors, J. P., Lei, S., & Kelly, M. 2012. Citizen science in the age of neogeography: Utilizing volunteered geographic information for environmental monitoring. *Annals of the Association of American Geographers*, *102*(6), 1267-1289.

Crooks, A. T., & Wise, S. 2013. GIS and agent-based models for humanitarian assistance. *Computers, Environment and Urban Systems 41*: 100-111.

Evans, A. M., & Campos, A. 2013. Open government initiatives: Challenges of citizen participation. *Journal of Policy Analysis and Management*, *32*(1), 172-185.

Fafchamps, M., & Moradi, A. 2015. Referral and job performance: evidence from the Ghana colonial army. *Economic Development and Cultural Change*, 63(4).

Farina, C. R., Epstein, D., Heidt, J., & Newhart, M. J. 2014. Designing an Online Civic Engagement Platform: Balancing "More" vs."Better" Participation in Complex Public Policymaking. *International Journal of E-Politics*, *5*(1), 16-40.

Fowler, A., Whyatt, J. D., Davies, G., & Ellis, R. 2013. How Reliable are Citizen‑Derived Scientific Data? Assessing the Quality of Contrail Observations Made by the General Public. *Transactions in GIS*, *17*(4), 488-506.

Grossman, Guy, Macartan Humphreys and Gabriella Sacramone-Lutz. 2014. Does Information Technology Flatten Interest Articulation? Evidence from Uganda. Forthcoming, *American Political Science Review*.

Grossman, G., Humphreys, M., & Sacramone-Lutz, G. 2015. Information technology and political engagement: mixed evidence from Uganda. Working paper.

Humphreys, Macartan and Jeremy Weinstein. 2013. Policing Politicians: Citizen Empowerment and Political Accountability in Uganda - Preliminary Analysis. London School of Economics International Growth Centre Working Paper.

Kampala City Council. 2006. Kampala Solid Waste Management Strategy. Kampala: Kampala City Council.

Katusiimeh, Mesharch W., Arthur P. J. Mol, and Kees Burger. 2012. The Operations and Effectiveness of Public and Private Provision of Solid Waste Collection Services in

Kampala. *Habitat International* 36 (2): 247-52.

Kinobe, J. R., Niwagaba, C. B., Gebresenbet, G., Komakech, A. J., & Vinnerås, B. (2015). Mapping out the solid waste generation and collection models: The case of Kampala City. *Journal of the Air & Waste Management Association*,65(2), 197-205.

Linders, D. 2012. From e-government to we-government: Defining a typology for citizen coproduction in the age of social media. *Government Information Quarterly*, *29*(4), 446-454.

McCormick, S. 2012. After the Cap: Risk Assessment, Citizen Science and Disaster Recovery. *Ecology and Society 17*(4): 31.

McGuire, M. 2006. Collaborative public management: Assessing what we know and how we know it. *Public Administration Review*, *66*(s1), 33-43.

Mossberger, K., Wu, Y., & Crawford, J. 2013. Connecting citizens and local governments? Social media and interactivity in major US cities. *Government Information Quarterly*, *30*(4), 351-358.

Munro, R. 2013. Crowdsourcing and the crisis-affected community. *Information Retrieval*: 1-57.

Ntaliani, M., Costopoulou, C., & Karetsos, S. 2008. Mobile government: A challenge for agriculture. *Government Information Quarterly*, *25*(4), 699-716.

Oates, Briony J. 2003. The potential contribution of ICTs to the political process. *Electronic Journal of e-Government* 1(1): 31–39.

Okot-Okumu, James and Richard Nyenje. 2011. Municipal Solid Waste Management Under Decentralization in Uganda. *Habitat International* 35(4): 537-543.

Olken, Benjamin. 2007. Monitoring Corruption: Evidence from a Field Experiment in Indonesia. *Journal of Political Economy* 115: 200-249

Oteng-Ababio, Martin. 2010. Private Sector Involvement in Solid Waste Management in the Greater Accra Metropolitan Area in Ghana. *Waste Management & Research* 28 (4): 322-29.

Reinikka, R., & Svensson, J. 2011. The power of information in public services: Evidence from education in Uganda. *Journal of Public Economics 95*(7): 956-966.

Rotberg, R. I., & Aker, J. C. 2013. Mobile phones: uplifting weak and failed states. *The Washington Quarterly*, 36(1), 111-125.

Saxton, G. D., Oh, O., & Kishore, R. 2013. Rules of crowdsourcing: Models, issues, and systems of control. *Information Systems Management*, *30*(1), 2-20.

See, L., Comber, A., Salk, C., Fritz, S., van der Velde, M., Perger, C., ... & Obersteiner, M. 2013. Comparing the quality of crowdsourced data contributed by expert and non-experts. PloS one, 8(7), e69958.

Seidel, C. E., Thapa, B. E., Plattfaut, R., & Niehaves, B. 2013. Selective crowdsourcing for open process innovation in the public sector: are expert citizens really willing to participate?. In *Proceedings of the 7th International Conference on Theory and Practice of Electronic Governance* (pp. 64-72).

Seltzer, E., & Mahmoudi, D. 2013. Citizen participation, open innovation, and crowdsourcing: Challenges and opportunities for planning. *Journal of Planning Literature*, 28(1): 3-18.

Stanley, J. W., & Weare, C. 2004. The Effects of Internet Use on Political Participation Evidence From an Agency Online Discussion Forum.*Administration & Society 36*(5): 503-527.

van der Windt, P., & Humphreys, M. (2014). Crowdseeding conflict data. *Journal of Conflict Resolution*, forthcoming.

Vermeiren, Karolien, Anton Van Rompaey, Maarten Loopmans, Eria Serwajja, and Paul Mukwaya. 2012. Urban Growth of Kampala, Uganda: Pattern Analysis and Scenario Development. *Landscape and Urban Planning* 106 (2): 199-206.

Weber, L. M., Loumakis, A., & Bergman, J. 2003. Who participates and why? An analysis of citizens on the Internet and the mass public. *Social Science Computer Review 21*(1): 26-42.

World Bank. 2007. Project Appraisal Document: Kampala Institutional Infrastructure Development Project. Washington, D.C.: The World Bank.

World Bank. 2014. Implementation Completion and Results Report: A Kampala Institutional Infrastructure Development Adaptable Program Loan (APL) Project. Washington, D.C.: The World Bank.

Zook, M., Graham, M., Shelton, T., & Gorman, S. 2010. Volunteered geographic information and crowdsourcing disaster relief: a case study of the Haitian earthquake. *World Medical & Health Policy 2*(2): 7-33.

Zurovac, D., Talisuna, A. O., & Snow, R. W. 2012. Mobile phone text messaging: tool for malaria control in Africa. *PLoS medicine 9*(2): e1001176.