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Authors
Ferree, Karen E
Gibson, Clark C
Jung, Danielle F
et al.

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Abstract

How does technology shape political participation in emerging democracies? By lowering costs, technology draws new participants into politics. However, lower costs also shift the composition of participants in politically important ways, attracting more extrinsically motivated individuals and a "crowd" that is more responsive to incentives (malleable) and sensitive to costs (fragile). We illustrate these dynamics using VIP:Voice, a multi-channel information and communication technology (ICT) platform we built to encourage South African participation in the 2014 national elections. VIP:Voice allowed citizens to engage via low-tech mobile phones and high-tech social media, and randomized incentives for participation. VIP:Voice generated engagement in over 250,000 South Africans, but saw large attrition as we switched from low to high-cost forms of engagement. Attrition was particularly large for extrinsically motivated participants. Crowds generated through ICT may therefore be large and easily generated, but comprised primarily of extrinsically motivated individuals whose participation decays with shifting costs.

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1 Introduction

Healthy democracies require active citizen participation, from monitoring government performance to voting. Yet citizens in emerging democracies frequently face barriers that marginalize them from political processes. Governments engineer exclusion by limiting information, controlling media, constraining efforts to organize, and subverting institutions like elections. Low education levels, limited financial resources, geographic remoteness, and unfamiliarity with political processes may create additional challenges for individuals in these societies.

The spectacular growth of information and communications technology (ICT) has fundamentally altered the technological landscape of developing countries, providing new and potentially powerful tools supporting citizen mobilization. These technologies radically reduce costs of communication, facilitating information-sharing and collective action across a large and dispersed user base. By lowering engagement costs, they help citizens in emerging democracies overcome barriers to organization. As participation grows, so too might the responsiveness of governments to the needs of the electorate.

The political consequences of these new technologies extend beyond increasing participation levels. In the process of drawing in new participants, ICT may also alter the composition of the participant group, or the "crowd," as we refer to it here. Citizens vary in their motivations to participate in politics. Following convention in behavioral economics, we differentiate between intrinsically and extrinsically motivated individuals. An internal commitment to political action drives the intrinsically motivated, who participate regardless of external considerations. These are people who, in spite of great risk and/or in the absence of immediate rewards, engage in political action. In contrast, the participation of extrinsically motivated individuals reflects external costs and benefits: they will participate, but only when incentivized to do so by an advantageous configuration of pay-offs. We argue that technology that reduces the costs of participation also alters the balance of intrinsic and extrinsic participators in the crowd. When political action is "high cost," only the intrinsically inspired participate. As costs drop, however, the composition of the participant group shifts to include more extrinsically motivated people.

Critically, changes in technology that reduce costs—such as those introduced by the ICT revolution—may encourage more participation, while also fundamentally altering the nature and composition of that participation. These composition effects, in turn, have important political implications. As the crowd comes to comprise more extrinsically motivated people, it becomes more sensitive to external costs and benefits. It is thus easier to manipulate through incentives but also more fragile to changes in the cost environment. Crowds generated through new information technologies may therefore be large and easy to generate, but decay quickly as costs shift. Such crowds thus present a very different political force—with potentially different demands of government—compared to those generated through more traditional methods and comprised of true believers who participate regardless of external incentives. How technology shapes costs and interacts with individual motivations to participate therefore has important implications not only for the size and composition of the crowd, but also how crowds grow or decline over time.

Recent research has focused on how new ICT can increase political participation and facilitate interactions within political organizations and movements (Bailard and Livingston 2014, Breuer, Landman and Farquhar 2015, Callen et al. 2016, 2013, Cecchini and Scott 2003, DeRenzi et al. 2011, Findley et al. 2012, Grossman, Humphreys and Sacramone-Lutz 2014, Tufekci and Wilson 2012, Van der Windt and Humphreys 2014), but few studies examine the effect of technology on the composition of participants. Of these, only Grossman, Humphreys and Sacramone-Lutz (2014) explicitly considers the selection effects of technology and how these shape the participant crowd.[1]

Our work builds on and advances these prior studies, exploring a wider range of costs and how they shape the evolution of participation over time. To explore how selection through technology affects the composition and nature of political participation, we designed and built a nationwide ICT platform ("VIP:Voice") to encourage citizen engagement in the 2014 South African election. To our knowledge, VIP:Voice is the largest, built-from-scratch, free-standing ICT platform developed for use in an emerging democracy's election. Because VIP:Voice did not rely on any pre-existing structure or defined set of users, it provides an unusually pure proof of concept as to whether and how technology engenders political participation.

South Africa presents an excellent setting to explore the potential for ICT to generate political participation in emerging democracies. Involvement in elections is far from universal in South Africa and uneven engagement reflects conditions common across emerging democracies like variable socioeconomic conditions, frustration with the performance of a dominant ruling party, and a lack of robust opposition parties. Additionally, like many developing countries, South Africa has enjoyed rapid expansion of ICT in recent years. Technological advances in South Africa outpace other parts of Africa, but still vary significantly within the country, with many citizens still using standard phones while others have internet-capable devices. Given the rapid rate of ICT growth, South Africa represents where much of Africa will be in a few years'

[1]In a related vein, Morozov (2011) argues that lowering transaction costs through social media may motivate individuals to engage more in expressive politics than the risky strategy of physical protest.

time.

VIP:Voice enabled us to study the effects of three types of costs on participation: ease of use, type of activity, and cost of interaction. On the first, we constructed VIP:Voice across five ICT channels: USSD, a standard phone (not internet capable) channel; Mobi (mobile web for internet-capable devices); Mxit (South Africa's largest social network); GTalk (google chat), and Twitter. These channels varied in their degree of sophistication and usability, with USSD offering the simplest and most basic option available to the largest number of South Africans, but also the one that was most difficult and time consuming to use as it required the operator to navigate through drop down menus without a touch screen. Second, VIP:Voice explored a variety of forms of participation, ranging from low cost digital activities to more costly real-world ones. In its initial digital phase, VIP:Voice encouraged a wide range of relatively easy types of engagement like answering on-line surveys and reporting on campaign activities. It then transitioned to more demanding forms of participation centered around citizen election observation. We can thus observe how the level and composition of participation changes as we switch from easy activities to hard ones. Finally, VIP:Voice allowed us to manipulate experimentally the actual cost of interaction, incentivizing some interactions but not others.[2]

To preview results, we find substantial support for our expectation: technology costs shape both the size, composition, and durability of the crowd. First, the size of the crowd responded to changes in the cost structure. Although a significant number of South African citizens engaged with VIP:Voice even in the absence of external incentivization and at cost to themselves—suggesting some degree of intrinsic motivation to participate—the number of participants nonetheless increased sharply in response to reductions in the cost of interaction. Participation also responded strongly to changes in the cost of the participatory act, dropping significantly as the project shifted from relatively costless digital engagement to costly real-world activities. While we were able to induce digital participation in over 250,000 participants, ultimately only a fraction served as volunteer observers and showed up to enter data from polling stations. Second, changes in ease of use and cost of interaction affected the composition of the crowd. Different channels generated user populations with different demographic characteristics and levels of intrinsic motivation to participate. Third, these composition effects in turn affect the durability of the crowd and how it responded to changing costs. As noted, switching from lower cost digital communication via VIP:Voice to higher cost activities like citizen election observation significantly reduced overall participation, but the decline was more prominent in

[2]The "standard" USSD arm makes individuals pay all messaging costs, the "free" USSD arm eliminates user costs, and the "lottery" USSD arm offers a chance to win 55 South African Rand (about 85 U.S. cents).

individuals identified as extrinsically motivated. Increasing the costs of action also produced the steepest decline in individuals who entered through "easier" channels. These channels experienced the greatest attrition as costs rose, suggesting a less intrinsically motivated, more fragile crowd than that generated by costlier technology channels. Users drawn in through extrinsic rewards (via lottery) also proved more responsive to subsequent incentives, suggesting a more malleable group than one generated in the absence of rewards. In sum, we show that costs shape not only the number and composition of participants in the political process, but their subsequent responsiveness to incentives and likelihood of moving from digital to real-world activities. Lower costs increase the crowd, but they also make it more sensitive to external changes in cost.

Our paper contributes to three literatures. First, we provide micro-foundations to a rich set of findings on political participation in developing democracies (Bratton, Mattes and Gyimah-Boadi 2005, Kasara and Suryanarayan 2015, Kuenzi and Lambright 2010). Other studies have noted numerous institutional and personal constraints on participation. Many of these factors operate by imposing costs on individuals that limit participation. Drawing on insights about intrinsic and extrinsic motivation from behavioral economics, we argue that cost reducing changes in the external environment do more than increase the level of participation. They also alter the nature of the participating group. Shifts in the composition of the crowd in turn shape its resilience to external challenges. We focus on technology change, but any factor that alters the costs of participation is likely to have these composition effects.

Second, we contribute to studies on the growing prominence of ICT in political mobilization and regime transition. ICT played a central role in facilitating citizen protest in the Arab Spring and Color Revolutions (Breuer, Landman and Farquhar 2015, Tufekci and Wilson 2012), which raises the question of whether ICT can be used proactively to engineer participation. Our work highlights the opportunities and challenges of doing so: ICT can generate large and impressive crowds by lowering costs of participation, but these crowds may prove ephemeral in the face of rising cost and activities that entail real risks. The "fragility" of such a crowd directly impacts the form and content of citizen mobilization, in contrast to crowds selected through more technologically challenging conditions that are smaller, but more likely to be composed of true believers who persist in political action.

Third, we lend to the growing empirical literature addressing the adoption of ICT platforms across a wide variety of developing country contexts, including in agricultural markets (Aker 2010, Aker and Fafchamps 2010), health (Baird et al. 2012, Chang et al. 2011, Dammert, Galdo and Galdo 2014, Pop-Eleches et al. 2011), uptake of social benefits (Blanco and Vargas

2014), education (Aker, Ksoll and Lybbert 2012), and mobile money (Blumenstock, Eagle and Fafchamps 2016, Jack and Suri 2014). Specifically, we lend insights and methods to studies using new techniques to address improving electoral processes (Callen et al. 2016, Callen and Long 2015, Collier and Vicente 2014, Ichino and Schüdeln 2012). Our results highlight the promises and constraints of citizen-based ICT interventions, and we demonstrate that such a model obtains cost-effectiveness at scale if the number of monitored states increases and the data provided from those stations improves. We complement a rich body of studies that underscore the opportunities and challenges of traditional election monitoring (Hyde 2011, Kelley 2012). Citizens may provide valuable information on elections to bolster the efforts of other groups' and organizations, and ICT platforms can incorporate volunteers and professional monitors from pre-existing organizations alongside of ICT-generated citizen participants.

We structure our paper as follows: Section 2 motivates our theory underlying political participation, and Section 3 describes the study context and design, and offers an overview of participation and representivity. Section 4 presents the empirical results, beginning with the hypotheses for which we have observational variation then proceeding to experimental tests on the role of incentives. Section 5 concludes.

2 Theoretical Motivation

2.1 New Technologies and Participation in Developing Democracies

Social scientists have long studied the factors driving political participation in consolidated democracies (Nie, Kim and Verba 1978, Wolfinger and Rosenstone 1980). More recent work extends the analysis of participation to emerging democracies (Bratton, Mattes and Gyimah-Boadi 2005, Kasara and Suryanarayan 2015, Kuenzi and Lambright 2010), where the determinants and contours of participation are distinct. Imperfect and incomplete regime transitions curtail citizen involvement and strengthen marginalization. Citizens may have only weak associations with inchoate democratic institutions, and those institutions sometimes create severe constraints on participation. Political actors motivate or discourage the extent and nature of citizen action, taking advantage of individuals more vulnerable to external pressures or rewards (such as vote-buying) and weak enforcement of electoral safeguards (e.g., ballot secrecy) (Ferree and Long 2016, Gans-Morse, Mazzuca and Nichter 2014, Kramon 2009, Nichter 2008, Stokes 2005). Individual-level factors like low levels of literacy and information may also affect participation.

In light of these realities, widespread and rapid adoption of ICT by citizens of developing democracies presents a promising new set of opportunities to encourage participation (Alozie, Akpan-Obong and Foster 2011, Bailard 2012, Bratton 2013, Shirazi 2008). Mobile phones alter communication costs and consequently reduce barriers to information-sharing between actors and individuals—including governments, political parties, civil society groups, and ordinary citizens. Low entry prices encourage broad use to exchange information across demographic groups and long distances (Aker and Mbiti 2010). The concomitant increase in internet access via feature and smartphones, and the popularity of social networking, further enhance the range of communication modalities available to citizens.

Research documents the impact of ICT on a wide range of development and governance outcomes,including political participation. For example, several studies suggest that ICT played a central role catalyzing spontaneous citizen-generated forms of protest and subsequent political change in routine elections (Suarez 2006) as well as the Arab Spring and Color Revolutions (Breuer, Landman and Farquhar 2015, Tufekci and Wilson 2012). Others explore how local activists, organizations, and donors can use ICT to engage citizens in the promotion of democracy and governance in the developing world across applications like improving electoral integrity (Bailard and Livingston 2014, Callen et al. 2016); crowd-sourcing information on violence, corruption, and government performance (Callen et al. 2013, Cecchini and Scott 2003, DeRenzi et al. 2011, Findley et al. 2012, Pierskalla and Hollenbach 2013, Shapiro and Weidmann 2015, Van der Windt and Humphreys 2014); and strengthening accountability between citizens and politicians (Grossman, Humphreys and Sacramone-Lutz 2014). In some instances these projects expressly attempt to increase the political engagement of citizens marginalized by standard political processes like the poor, those in peripheral regions, and women (Findley et al. 2012, Grossman, Humphreys and Sacramone-Lutz 2014). While this research shows success in generating some types of participation, high attrition from original intake samples present challenges. These patterns hold particularly for projects that require costly action. Citizens' use of new technology may therefore still encounter significant barriers in developing countries, and issues such as literacy, connectivity, and the costs of technology may ironically limit the participation of precisely those citizens who already face exclusion from political activity.

Previous work on ICT and political participation have focused almost exclusively on how technology can increase the number of people participating in political action, that is, the *size* of the crowd. The *composition* of participation, and how technology influences the selection of different groups into political action, has received scant attention in the literature. One exception is Grossman, Humphreys and Sacramone-Lutz (2014), who show that an ICT platform in Uganda drew in participants from traditionally under-represented groups (women, the poor).

2.2 A Model of Technology-Assisted Participation

We address this lacuna in the literature, focusing on how technology induces selection effects that shape the composition of the crowd. We begin by differentiating between intrinsically and extrinsically motivated participants,[3] and then discuss how changes in costs of participation driven by technology affect the mix of these two types in the participant crowd. We argue that cost-reducing technological advances draw in more extrinsically motivated individuals. When participation is costly, the set of participants is therefore likely to consist primarily of those with deep intrinsic motivations for engaging. In contrast, when costs fall, a less intrinsically motivated crowd emerges. The composition of the crowd in turn affects how it responds to future costs and incentives. A less intrinsically motivated crowd responds well to external incentives and is therefore malleable. But this crowd is also more fragile in the face of rising costs and likely to fade as activities become more demanding.

We present an intuitive model that demonstrates the impact of technology change on participation. To capture the variation generated by our study, we highlight four dimensions of heterogeneity: individual intrinsic motivation, platform-specific technology costs, participation incentives, and types of political activity. First, individuals vary in their intrinsic motivation to engage in politics; some possess a strong internal desire to participate and do so regardless of external costs and benefits, while others do not, and engaging only when external incentives to engage are favorable. Individuals on the higher end of the intrinsic motivation spectrum will participate in political action even if the technology for doing so proves cumbersome and costly. Second, technology affects the cost of participation, with some technology channels imposing high costs and others imposing lower ones. The ICT revolution can be thought of as a sea change in the cost of participation, but we can differentiate high-cost channels on traditional devices from those involving simpler interfaces on newer more sophisticated ones (e.g., smartphones). Third, additional external inducements may enhance participation rates (analogous to parties buying votes, giving gifts, or lowering the costs of voting by providing free transportation). Finally, the actual political actions in which people engage may be low-cost (responding to survey requests) or high cost (volunteering to serve as a citizen election monitor). We call the former "digital" forms of participation in this paper, and the latter "real-world" forms, but

[3]Evidence from multiple disciplines examines the interplay between intrinsic and extrinsic motivations (Findley et al. 2012, Gneezy and Rustichini 2000), including their effect on candidate selection (Isbell and Wyer 1999), principal-agent relationships (Benabou and Tirole 2003), and motivations to work (Gagné and Deci 2005).

this is short-hand for low and high costs.

We can now parameterize these forms of heterogeneity. Individual heterogeneity in citizen motivation to participate in political activity is characterized by η_i, distributed as $Unif[0, \bar{\eta}]$. A high η implies strong intrinsic motivation to engage in political action. Our model involves two periods: the first involves low cost "digital" forms of participation; the second, higher cost "real-world" forms of participation. In period 1, citizen i is assigned to a technology channel j, which bears costs c_j. Participants may be offered an external incentive to engage in period 1 $\beta_{i1} > 0$; we assume that only those who engage in the first period can be incentivized in the second period. Finally, those participants remaining on the platform in the second period are invited to engage in a high-cost, 'real-world' form of participation which bears additional costs $R > c_j$, constant across platform.

Given intrinsic motivation η_i, platform-specific costs c_j, and individual-specific incentives to participate β_{it}, period 1 participation will explained by the indicator function $P_{ij1} = 1\big(\eta_i + \beta_{i1} - c_j\big)$, requiring the sum of intrinsic and extrinsic incentives to exceed c_j, the channel specific cost of participation. Intuitively, participants select into participation in the first period only if the sum of their intrinsic benefits and their extrinsic reward is lower than the cost of participation in a particular channel. Given this simple setup, the participation *rate* $E(P_{j1}) \equiv \rho_{j1}$ for channel j will be $\frac{\bar{\eta}+\beta_{i1}-c_j}{\bar{\eta}}$, and the average intrinsic motivation on a channel as a function of the costs and extrinsic incentives will be $E(\eta|P_{ij1} = 1) = \bar{\eta} - \frac{\bar{\eta}+\beta_{i1}-c_j}{2}$. These equations define the "crowd" that forms for period one digital activity as ICT and subsidies drive down the net costs of political participation in an given activity. As costs c_j fall the crowd is larger and comprised of more extrinsically motivated participants.

In period 2, citizens are asked to switch to a high cost "real-world" activity that bears a cost R, which is invariant regardless of the channel through which a citizen was recruited. We assume $R > c_j$ for all channels. As citizens are only present to be incentivized in period 2 if they participated in period 1, it is natural to define participation in the second period costly activity as:

$P_{ij2} = 1$ if $\big((\eta_i + \beta_{i1} > c_j)\big)$ & $\big((\eta_i + \beta_{i2} \geq R)\big)$,

$P_{ij2} = 0$ if $\big((\eta_i + \beta_{i1} > c_j)\big)$ & $\big((\eta_i + \beta_{i2} < R)\big)$

Given this, a shift in period 2 incentives β_{2j}, will have an effect on period two participation rates only if it operates on a subset of individuals opt into participation in the first period based on the first period costs and incentives. Thus,

$$\frac{d\rho_{j2}}{d\beta_{i2}} = \begin{cases} \frac{1}{\bar{\eta}} & \text{if} \quad (R - \beta_{i2} > (c_j - \beta_{i1}) \\ 0 & \text{else} \end{cases}$$

Consequently, the higher the incentives in the first period (β_{j1}), the higher the probability that the type of individual for whom incentives are effective on the margin is still in the user group in the second period. In other words, by offering incentives in the first period, a crowd is formed that consists of larger numbers of people who are sensitive to incentives, i.e., malleable; in the second period, incentives are therefore likely to be more effective in prodding participation than they would have been in the absence of first period incentives.

If we calculate second period participation rates as a fraction of those who participated in the first round (and ignoring incentives), then the fraction of first-period participants that also participate in the second period will be $\frac{\bar{\eta}-R}{\bar{\eta}-c_j}$. Thus, the lower the channel specific costs in the first period, the smaller the share of the recruited crowd willing to engage in costly action in the second period.

Fragility Hypotheses, based on *motivation* and *action* and *channel* costs:

H1a: Participation will fall as individuals are asked to move from low-cost to high-cost forms of participation ($E(\rho_1) > E(\rho_2)$ because $R > c_j$).

H1b: The drop in participation as we move to high cost actions will be largest for the lowest-cost channels (high cost participation as a fraction of low cost participation will be $\frac{c_j}{R}$).

H1c: The drop in participation as we move to high cost actions will be largest for individuals with the lowest intrinsic motivations for participation.

Malleability Hypothesis based on *incentives*:

H2: Participation will increase with extrinsic incentives $\left(\frac{d\rho_{j1}}{d\beta_{j1}} = \frac{1}{\bar{\eta}} > 0\right)$.

Hypotheses based on the *dynamics* of incentives:

H3a: The marginal effect of incentives on participation in the second period will be larger for the group given incentives to enroll in the first period. (The likelihood that $\frac{d\rho_{j2}}{d\beta_{i2}} > 0$ is increasing in β_{j1}).

H3b: The differential response to period 2 incentives for the initially extrinsically motivated group disappears as individuals are asked to undertake actions with high costs (as soon as $R > c_j + (\beta_{i2} - \beta_{i1})$, $\frac{d\rho_{j2}}{d\beta_{j2}} = \frac{1}{\bar{\eta}}$ in both groups, there is no differential effect).

This model of repeated attempts to engage citizens illustrates the challenges and dynamics that shape the crowd across technologies, actions, and time. When we use ICT to engage people in digital, low-cost forms of political engagement, participation will be forcefully driven by the technology at hand. However, once we try to induce participation in more traditional, high-cost political actions, the benefits from technology fade. Those induced to participate through lower technology costs drop away, and the crowd that remains is simply the one that would have been there in the absence of the technologically induced change. Similarly, incentives generate dynamic effects. Because the initial use of incentives retains a less motivated group, more people participate subsequently only if offered incentives. In the language used earlier, the shift in costs produced by technology changes creates a malleable but more fragile crowd.

These selection dynamics in turn have broad implications for the nature of political action. Crowds raised through cost-reducing technologies like ICT may appear impressively large, but are not likely to prove durable in the face of political actions that entail real risks and costs. In contrast, crowds selected through more technologically challenging conditions may be smaller, but are also likely to be composed of true believers who persist in political action even when doing so is difficult and risk laden.

To test our hypotheses, we built VIP:Voice, a free-standing multi-channel ICT platform during the 2014 South African election. Through VIP:Voice we explored variation across channel and activity costs, as well as randomized participation incentives. In the next section, we introduce this platform and discuss how we used it to explore the model presented here.

3 Setting and Research Design

3.1 Setting: The 2014 South African Election

South Africa provides a compelling setting for a study of political participation in an emerging democracy. South Africans reflect characteristics of voters in other settings where variation in institutional and individual factors results in differential rates of political participation. The country also sits at the forefront of ICT growth in the developing world, making it an important case to test our hypotheses.

1994's transformative elections brought an end to apartheid, allowing universal franchise and energizing democratic participation on the part of the non-white majority (Johnson and Schlemmer 1996, Reynolds 1994). Since then, the ruling African National Congress (ANC) has won national contests with consistently wide margins, greatly outpacing its nearest competitor, the Democratic Alliance (DA); other smaller parties have not gained much traction (Ferree 2011). The ANC's dominance limits political competition, potentially discouraging participation since elections are seen as foregone conclusions. Turnout for national elections has dropped nearly 30 percentage points from 1994 to 2014, with lowest rates in the youngest groups of eligible voters (Schulz-Herzenberg and Southall 2014).

Beyond the party system, the economic and social remnants of apartheid still affect South African society and political participation. Although now in the political majority, many blacks do not feel that the ANC's performance lives up to the promises made as apartheid ended. The 2015 unemployment rate of 26% is the highest in a decade, and over half of black youths are jobless. While whites retain many economic privileges, they lack representation in the ANC. Regardless of race, many voters increasingly perceive the ANC, and incumbent president Jacob Zuma, as corrupt (Southall 2014).

But while election turnout may be in decline, South Africans have a long tradition of political activism. Demonstrations and riots were common features of the anti-apartheid era (Lodge 1983, Lodge and Nasson 1991). More recently, South Africans have staged widespread protests against the state for its poor record of delivering basic services (Alexander 2010, Southall 2014). Since 2008, more than two million South Africans have participated in service delivery protests (Plaut and Holden 2012). Thus, South Africa, like many emerging democracies, has a record of uneven political participation.

In technological development, South Africa has enjoyed a "tech boom" in recent years. It boasts the highest cellular phone connections per capita in Africa[4] and the fifth highest internet access rate. Cell phone saturation was almost 90% in the 2011 census and has since risen to almost 100%. Web-enabled feature phones and smartphones currently have a saturation rate of 70%. More economically developed areas of South Africa have higher usage rates, as do younger and more male populations.[5]

3.2 Research Design

To examine the crowd and its responsiveness to costs and incentives, we built a free-standing ICT platform to encourage participation in the 2014 election. Our project involved three stages: (1) registration in VIP:Voice, and then engagement (2) before, and (3) during the election. Here, we provide a summary overview of the sequence of the phases, followed by more detail in the next section. Figure A-1 displays a schematic of the overall design of the project, showing the temporal division of the study into three phases. Blue lines represent experiments conducted at different stages. The first of these experimentally varied incentives to register in Phase 1 (β_{j1}). We introduced additional experimental components in Phase 3.

We worked with Praekelt, a South African technology firm, to design a multi-channel ICT platform and recruit as broad a spectrum of the electorate as possible. Unlike studies that build ICT platforms from extant databases of prior users or conduct household surveys to enroll people, we obtained participants directly from the overall population via the platform. While this presented significant operational challenges, it also meant every South African voter could potentially enter the study sample and provides a robust proof of concept on purely digital recruitment.

[4]As of 2014, 149 connections per 100 citizens; Nigeria has 77.84 per 100 (World Bank 2014).
[5]See Appendix Table A-4.

In **"Phase 1,"** one month before the election,[6] we started enrollment of citizens into the platform. Users could interact with VIP:Voice through five channels: SMS/USSD, Mxit, Mobi, GTalk, and Twitter. Standard phones without internet required interaction via short message services (SMS or text messages) and unstructured supplementary service data (USSD), an interactive text-based system that can reach users of all types of phones. Mxit is South Africa's largest social network and works on feature and smartphones; Mobi is a provider of mobile web smartphone platforms; GTalk (Google Talk) and Twitter could be accessed by feature or smartphones. We built the platform to be as homogeneous as possible, with variation in interface ease of use due to channel. The most technologically sophisticated channels (those that required feature or smartphones) were also the easiest to use. In contrast, the more rudimentary SMS/USSD channel, available on even the most basic phones, was the clunkiest. Difference across these channels thus opertionalizes the concept of technology change: the SMS/USSD channel represents a high cost/hard to use technology channel; Mxit or Twitter represents a low cost/easy to use technology channel. Clearly this captures only a truncated range of the true distribution in this variable. Nonetheless, this range is relevant to the technology landscape in many developing countries, where most citizens have access to some form of ICT, and the important variation is between those with very basic phones and those with internet enabled smart phones.

To reach the largest possible group of potential participants, we focused heavily on SMS/USSD interactions, which have the widest penetration, including rural areas where other digital media may not have had the same reach. We attracted people to this channel primarily through advertising with Please Call Me (PCM) messages. Facilitated by telecom providers, South Africans send an average of 14 million overall unique PCMs per day. Senders text a PCM to a recipient, requesting a return phone call. The recipient of a PCM sees the number requesting a call as well as an ad. Advertisers pay for PCMs, not senders. As far as we know, VIP:Voice is the first major platform of its kind to use PCMs as a recruitment tool. We purchased ad space for VIP:Voice for 49.8 million PCMs and randomized the PCM message with a "standard" arm encouraging registration, but users pay full messaging costs; a "free" arm with no interaction fees; and a "lottery" arm offering a chance to win R55.[7] On entering the system, users were asked a teaser "engagement" question about their voting intentions in the election[8] and then asked to sign the Terms and Conditions to register in the system. We recruited for the other channels using splash ads and banners as well as a standard media campaign.[9]

[6]Beginning April 7, 2014.

[7]The text of the PCM message always read *"Join VIP:Voice to help make elections 2014 free and fair. Dial ..."*. The standard treatment said *"Standard rates charged,"* the free treatment said *"participate for free,"* and the lottery treatment said *"stand a chance 2 win R55 airtime"*.

[8]"It's election time! Do u think ur vote matters?" Response options included, "YES, every vote matters," "NO, but I'll vote anyway," "NO, so I'm NOT voting," "I'm NOT REGISTERED to vote," and "I'm TOO YOUNG to vote."

[9]We conducted the standard media campaign piggybacking on Livity Africa's "Voting Is Power" (VIP) campaign, leveraging their existing reputation as a respected, non-partisan, youth-oriented media outlet.

The total recruitment effort, including close to 50 million PCM messages, logged roughly 263,000 individuals contacting the platform, 134,047 responding to the initial engagement question, and 90,646 completing the Terms and Conditions.[10] Just under half of registrants entered through the PCM-linked USSD channels; a similar number entered via Mxit. The remainder came in through Mobi or print advertising, and a very small number entered via GTalk or Twitter.[11] We define the strata for the study as the intersection of the channels and the USSD recruitment randomization groups, meaning that some comparisons are experimental (the USSD PCM recruitment groups) and others observational (across channels). The three experimental USSD strata and the Mxit stratum contain almost 94% of registered users.

Table 1 provides the total number of individuals at various stages on the participation waterfall, broken down by strata. Because multiple PCMs may be sent to the same person, we cannot define uptake in the usual way for this experiment. Rather, we divide registered users by the number of PCMs sent under each treatment to calculate a yield rate, implying an average yield rate of .08% per PCM for the USSD channels, or 1 in 1,900 PCMs.[12] Only one third of those who initiated contact with VIP:Voice completed registration.

In **"Phase 2,"**, digital engagement, the platform invited registered individuals to provide their demographic data and report on election-related events with information pushes and pulls leading up to election day. Participants continued engagement through their original enrollment channel. In practice, Phase 2 involved completing five separate pre-election surveys. The first survey asked a brief set of demographic questions, completion of which we monetarily incentivized with a lottery for all users. The other four survey activities involved (1) tracking local campaign activities, (2) evaluating ANC performance, (3) measuring election-related violence, and (4) a standard set of election polling questions. Users could complete surveys in any order, and failure to complete one survey did not preclude answering questions on others. Phase 2 thus consisted of low-cost digital forms of engagement as all activities involved interacting with the platform. Attrition continued in Phase 2. Of the 90,646 people registered, 34,727 (38%) completed the four demographic questions and 15,461 (17%) answered the demographic questions and one of the other four Phase 2 surveys.

In **"Phase 3"** we sought to evaluate whether we could enlist citizens into meaningful and costly real-world forms of participation exclusively through the VIP:Voice platform: observing and reporting on electoral outcomes at polling places. From the group of "high compliers" in Phases 1 and 2 (those who completed all

[10]Appendix Table A-1 shows the anticipated recruitment numbers provided by Praekelt; these were roughly four times the actual enrolled numbers.

[11]USSD users who enrolled in the program directly rather than by PCM may have come from print advertising, or heard about the platform through other channels but registered on a phone. This self-enrolled USSD group is not used in any experimental analysis because PCM treatment status cannot be assigned.

[12]This cannot be interpreted as a standard yield rate because PCMs may be sent many times to the same person and the same individual may have received PCMs with different treatment statuses. What we show here is the yield *per PCM*, not the rate *per person sent a PCM.*

or most questions), we garnered a set of volunteers to serve as Citizen Observers (COs). The tasks expected of COs involved returning to polling stations on the day after the election to observe whether or not a declaration of results form (tally sheet) had been posted, submiting information about the tally via SMS, and taking a photo of the tally if equipped with a camera-enabled phone.[13]

We randomized an extrinsic incentive to participate as a CO (randomized as either a token amount of R5 to cover phone fees or a more substantial inducement of R50). Those who indicated an interest in serving as COs received a new set of Terms and Conditions to accept and provided personal information to allow us to identify their polling stations. We subsequently refer to "CO volunteers" as those who volunteered as COs, signed new TCs, and provided personal information. We invited 50,995 participants to volunteer as COs. Of these, 2,507 agreed, signed the new TCs, and provided all relevant location information required to identify their polling place. We were thus able, through the platform alone, to recruit citizens willing to observe 12% of the polling stations in 38% of the wards in the country.

Our original design was to field these volunteers on the day after the election through additional messaging and instructions. Due to a data error, the platform sent these additional messages and instructions to an entirely different group of 1,899 individuals (who had not previously volunteered to be CO volunteers) asking them to observe the voting tallies the day after the election; of these unwitting volunteers, 350 submitted information via SMS about their polling stations. This second group were almost exclusively registered USSD participants in the "standard" arm. These COs were also offered one of two different incentives to complete their tasks (R5 or R50), and assignment to these incentives was as-if random.[14] Given that this variation arose as a result of a data error and was not strictly controlled by the researchers, we consider this latter incentive to form a natural experiment following Dunning (2012).

In our results, we differentiate between CO volunteers (those who signed up to serve but were not asked to complete the task) and actual COs (those who got the instructions, with no prior notice, and then went and tried to complete the task). Of some note, none of these individuals (CO volunteers or actual COs) received any kind of extensive training from VIP:Voice, nor any kind of face-to-face or personalized interaction with the system. They were called to action purely through the platform.

Participation levels across stages (summarized in Table 1) are impressive and sobering in equal measure. On the one hand, over 250,000 South African citizens initiated contact with the platform, more than 100,000

[13]Electoral law in South Africa requires posting of tally sheets by polling center managers. Posting of sheets improves electoral transparency, allowing voters to observe their local result. Observing whether or not a sheet has been posted represents a tangible election observing activity a citizen might reasonably (and safely) participate in that could provide useful information about the adherence of local polling stations to electoral procedures. By reporting information from the tally sheet, a CO also makes it possible to evaluate whether local posted results match centrally reported results (Callen and Long 2015). Hence, these activities represented valuable ways in which ordinary citizens can participate meaningfully in observing electoral equality.

[14]See Appendix Table A-3.

of these citizens provided information of some sort, over 90,000 registered into the system, and 2,500 people completed all the required information and registered as COs. On the other hand, this represents a tiny fraction of the individuals originally approached with PCM messages, and attrition at every step of the process—from contact initiation, to the enthusiasm question, registration, answering any of the Phase 2 questions, and volunteering as a CO—is on the order of 50% per step.

4 Hypothesis Testing

4.1 How Technology Shapes the Crowd

We now return to our hypotheses about how technology shapes the crowd. First, we examine how technology drives differences in participation by comparing demographic characteristics across channels. We then test H1 (fragility) in Section 4.2 with observational variation in costs across channels. We test H2 (malleability) and H3 (dynamics) in Section 4.3 using experimental variation in incentives.

At the outset, it is important to acknowledge some limitations of our data. One advantage of our PCM recruitment strategy is that it allowed us to reach a wide base of potential participants all throughout South Africa—in essence anyone with a basic cell phone. Other strategies, for example recruiting through a traditional door-to-door survey, could only replicate a similarly broad reach through massive field teams and costs. One disadvantage of the PCM strategy, however, is that we only had information about participants if they provided it to us within the platform. Hence, even in the simple descriptive endeavor of comparing demographic characteristics across technology channels, attrition across responses is a challenge: we can only compare attributes of those who agreed to give us their demographic information, which we cannot assume is random across channels and therefore may differ from the true (unobserved) distribution. Nonetheless, and keeping this caveat in mind, we use the 35,000 people who provided these data to compare to the overall South African population.

Table A-2 shows platforms generate user groups with radically different gender and racial compositions, and compares these to national averages. While the population is just less than half female, almost two thirds of the USSD users were women. In contrast, almost two thirds of the Mxit sample is male. The USSD group is also more black (94%) than the national population (79%), while the Twitter/GTalk group is less so (60%). Mobi, building off of social networks focusing on sexual health, is equally black and female but with average age almost three years younger than the USSD channels. The Mxit group is more Coloured (14%) and male (62%) than the population. Reported voting in the prior election is much lower than the actual turnout rate in 2009, most likely due to the fact that a large share of our users were not of voting age in 2009. Within the USSD group, the demographic profiles of the standard, free, and lottery groups are mostly similar; the lottery group is slightly older and slightly less black.

Given the sharp demographic differences across channels, we investigate whether age, gender, and/or race drive participation in the platform, rather than something inherent to the technology. Table 2 first provides summary statistics on participation across the study phases for each platform, and second a regression specification controlling for the (de-meaned) demographic variables. This method allows us to determine, if we removed the observable effects of age, race, and gender, whether participation across channels would still vary for this regression-adjusted "average" citizen. The first column shows the average participation rate among users by platform, the second column shows the same statistic within the sample for whom we have demographic data, and the third column controls for the de-meaned demographics. Despite very strong differences in participation across platforms, coefficients in the second and third columns are remarkably stable, enhancing our confidence that differences in participation across channels arise from some attribute of the technology itself, not user characteristics.

Table 3 illustrates, in line with our expectations, users on lower cost or higher incentive channels do indeed have a lower level of average user engagement in the political process than the higher-cost USSD platform. Here we leverage our initial engagement question, which asked "It's election time! Do u think ur vote matters?"[15] Because we asked this question very early in the process, we have responses from over 130,000 participants. We take intrinsically motivated individuals as those who give more optimistic 'yes' responses to this question, and fewer gloomy 'nos.' They should also be less likely to report not being registered. We focus especially on the MXIT versus USSD channels; and within the USSD channels, on the people incentivized to participate and those not incentivized. Over 90% of our participants fell in one of these groups, whereas Mobi and Twitter represent smaller strata.[16] We would expect highest intrinsic motivations in the non-incentivized USSD group: the technology was the least friendly to use, and participants were not compensated for their efforts. In contrast, we expect lower intrinsic motivations in the MXIT and USSD lottery group. Here the technology was either very easy to use (MXIT) or participants were compensated for their efforts (USSD lottery). These patterns emerge clearly in the data: the USSD non-incentivized group provided the highest percentage of straight-up 'yes' responses to the engagement question (almost 84%); the USSD lottery group was lower (79%) with the MXIT group the lowest of all (67%). This pattern is reversed for the 'no' and 'not-registered' responses. Thus, we have evidence channels not only select in different

[15]Response options included, "YES, every vote matters," "NO, but I'll vote anyway," "NO, so I'm NOT voting," "I'm NOT REGISTERED to vote," and "I'm TOO YOUNG to vote."

[16]The smaller group of Mobi and Twitter users appear highly engaged, which contradicts our expectations; this may suggest non-cost-based determinants of participation on these channels, such as the fact that Mobi advertising was directed in large part at the audience available on Young Africa Live, a web based Praekelt project directed towards educating young South Africans about sex, HIV/AIDS, rape, and gender issues. In essence, the Mobi group represented a previously organized and already engaged set of participants. We have no explanation for Twitter, but note only a tiny portion of our respondents engaged through Twitter.

demographic groups; they also select in differentially motivated participants—as expected.

Finally, we examine the extent to which the channels deliver a crowd with an unrepresentative political orientation. We conducted daily opinion polling, asking a randomized subset of registered participants about their voting intentions each day between the launching of the platform and several weeks after the election. Figure 2 plots the results of these "Activity" questions across platforms and days, comparing them to the actual election. All platforms for which we have a sufficient number of responses to plot averages (USSD, Mobi, and MXIT) have a user-base that is reliably more pro-ANC than the national population of voters. These patterns likely reflect the demographic profiles of these channels. On election day itself, the more ethnically diverse user-base on Mxit had voting intentions closest to the national average. USSD had an 11 point pro-ANC bias relative to the election outcome, and Mobi more than a 20 point pro-ANC bias. While we do not have enough responses from Twitter users to plot them over time confidently, only 17% of responses on this channel are pro-ANC, making it the sole channel with a pro-opposition slant. The overall platform support on election day is 69.8% and 12.9% for the ANC and DA while the actual election outcome was 62.1% and 22.2%, respectively.

4.2 Observational Tests of the Fragility Hypothesis (H1)

We next evaluate how participation responds to a shift from low-cost, digital-only participation to higher-cost forms of real-world participation.

H1a predicts users of the high-cost channel (USSD) should display greater intrinsic motivation than users of the lower-cost social media channels, and the USSD group who entered without receiving an incentive should be the most intrinsically motivated of all. As discussed, we exploit the engagement question, "Do you think your vote matters?" as a simple way of testing whether a channel's ease of use creates systematic variation in the intrinsic motivation of participants. We consider participants who answered "YES, every vote matters!" as those most inclined toward engagement, and respondents who did not feel their vote mattered and those not registered least inclined. Table 3 indicates that indeed the USSD group that received no experimental inducements to participate is highly engaged, the experimental group less so, and the large population of Mxit users were by far the least likely to fall in the enthusiastic camp. We next examine how the participation of these different groups responds to shifts in activity costs.

Early stages of VIP:Voice involved simple, relatively costless tasks like answering the engagement question and signing brief Terms and Conditions. Phase 2 continued with more intensive, but still completely digital engagement: answering anonymous survey questions. Phase 3 was a departure into costlier forms of real-world participation: CO volunteers provided information about their geographic location and signaled their willingness to serve as observers. Those who deployed participated in the costly action of returning to their polling station the day after the election to enter detailed information about the presence and content of the tally sheet. We anticipate participation should decay as tasks shift from easy, low cost, and digital forms to harder, higher cost, real-world forms of engagement (H1a).

At the same time, we do not expect participation to decay constantly across all participants. As noted, users vary in underlying inclination to engage in political action. Those with higher predispositions to engage should be more likely to continue participating in the platform even as costs increase. In contrast, those with weak predispositions to engage should respond more acutely to increasing costs.

To capture predispositions for engagement, we exploit selection effects generated by the different technology channels. Because digital engagement through Mxit and Mobi proved easier than through USSD (Table 1), we expect these platforms pulled in participants who re disproportionally more likely to drop off as engagement shifted from digital to real-world (H1b).

The data support both of these hypotheses (Figure 3). Across all channels, participation decreased in Phase 3, as expected (H1a). However, the decline in participation was steeper for the social media participants who faced lower initial barriers to enrollment in the platform than for the USSD participants (H1b).

In Table 2, we evaluate this point more systematically. Mxit generates a much higher number of Phase 2 responses than any other platform, but has a lower fraction of users volunteering in Phase 3 than any other platform. This remains true even controlling for demographic factors. Thus, Mxit users participated more extensively when participation involved only digital engagement; otherwise, their commitment proved more brittle than USSD users when confronted with real-world action.[17]

We examine the engagement question answers across rounds (H1c) to explore the relationship between attitudes about participation and attrition over time more directly. Table 4 presents these results. We split the answers into two different dimensions: first, *"does my vote matter"* (consisting only of the group that answered "YES, every vote matters") and second, *"will I vote"* (including the "No, but I'll Vote Anyway" group). The "No, but I'll Vote Anyway" group plays an important discriminating role identifying people disengaged but nonetheless planning on voting, giving particular traction on which kinds of real-world engagement relate to digital engagement.

Table 4 shows the perception of "does my vote matter" does not have any strong relationship with subsequent participation. Those who respond "YES, every vote matters" versus "No but I'll vote anyway" respond at relatively similar rates to all phases of the study. The second dimension, however, "will I vote", *strongly* predicts willingness to volunteer to observe and respond to post-election questions. These two groups respond at similar rates to registration and Phase 2 questions as those who will not vote, but volunteer to

[17] Again, the participation of the smaller group of Mobi and Twitter users evidences an enthusiasm that is in excess of what we would have expected based solely on cost of channel.

observe at rates two to three times as those who say they do not intend to vote. Citizen Observer volunteer rates are nearly twice as high for the group that intended to vote as the group that did not.

These results provide important linkages between "participation" in the virtual world and in real political activity. Engagement in the election does not predict digital participation when costs are low, but becomes strongly predictive once we use the digital platform to recruit real-world engagement. Put differently, the crowd recruited through extrinsic rewards was more vulnerable to subsequent increases in costs than the crowd not recruited this way. This relationship—arising from observational, not experimental data—offers a number of interpretations. For example, perhaps individuals already intending to vote face lower costs to observe their polling place, or perhaps common factors like proximity to polling places drive both. Nonetheless, observation activity was to take place the day after the election, requiring a return visit to the polling place whether or not a participant had voted. Hence voting intentions do not directly reverse-cause willingness to observe, and our results accord with the idea that those with high initial engagement are the most likely to remain involved as costs to participate rise with real-world demands.

Because the hypotheses involving c_j are tested observationally, we are sensitive to some limitations of this analysis. The extant crowd to whom we were able to offer our platform of course differs in many ways across channels. In this sense, differences our model ascribes to costs across channels may be caused by other, unobserved factors that lead to systematic variation in the user groups.[18] We also do not know the full size of the crowd on each channel, and hence cannot speak to participation rates among the universe of potential users, simply among those who initially enter the platform. Even with this caveat, the systematic variation we see across users of the different technologies (from a basic phone to Twitter) represents the actual population diversity in a national-scale platform. Therefore, it provides important information on the relative effectiveness of different technology channels in a large, diverse, developing democracy.

4.3 Experimental Tests of Malleability and Dynamics (H2 & H3)

Using the directly randomized participation incentives, we can extend the analysis of how net platform costs drive the crowd composition using experimental variation. The PCM recruitment experiment randomly assigned people to standard rates, free, or lottery incentives to participate. The standard rates treatment offered no financial incentive to join. In contrast, both the free or lottery treatments offered an incentive. We expect a positive level of participation in the standard arm, but anticipate it will be higher in no cost and lottery treatment arms (H2a).[19]

[18]For example, a variety of evidence presented suggests that the small group of users who entered the platform through Twitter is unusually engaged subsequently at all stages.

[19]We also anticipate the cost and lottery treatments may affect participation in different ways. Both are forms of extrinsic reward, and we expect both to increase participation relative to the "standard" USSD treatment (barring net crowd out). However, the free treatment offered a cost reduction (R0.2, about 1.5 US cents per USSD session)

Comparing the USSD Standard, Free, and Lottery columns of Table 5, we see 1 in every 1,900 PCMS without an incentive attached resulted in a registered user. Thus, it appears some fraction of the population will participate without incentives. Incentives are nonetheless effective; the yield rate jumps to 1 in every 1111 PCMs when some kind of incentive (free service or the lottery) is offered.

Incentives are similarly effective in the CO volunteer experiment in Phase 3, which randomized incentives (R5 or R55) to join (see Table 6). We conducted this experiment on 50,814 people. In the absence of incentives, 2.7% of the Standard USSD users invited to serve as COs volunteered (196 people). Incentives increased participation by close to 2 percentage points (significant at the .01 level). We emphasize that R5 is a small sum of money and the literature generally suggests that net crowd-out of intrinsic incentives will gain strength when extrinsic incentives are small (Gneezy and Rustichini 2000).

Actual election observation also responded to incentives (see Table 7). When offered payment of R5, only 12% of those deployed to observe entered any data on their polling places (96 people). In contrast, among those offered the more substantial payment of R55, this rate almost doubled to 21.9%. Within the sample that observed, the rate of successful entry of ANC voting data via SMS almost tripled, from 4.2 to 14.6% for those offered the larger incentive.[20]

While our data unambiguously show the effectiveness of incentives, we are struck by the evidence suggesting substantial numbers of intrinsic participators. Many of our participants were poor, using the most basic cellular technology. Yet, a substantial number participated in all phases, without incentives of any kind, in many cases paying the full cost of submitting information. We built VIP:Voice from scratch, without the backing of an on-the-ground organizational presence. We offered little feedback to participants and zero face-to-face interaction. The willingness of South Africans to engage with such a system, providing information about themselves and their political environment, and even in some cases volunteering to serve and actually serving as citizen election observers, highlights the importance of intrinsic motivations to participation.

Turning to the dynamic impact of incentives discussed in H3, we expect the marginal effect of incentives will be stronger in the group recruited through external incentives because this group includes more extrinsically motivated individuals. The crowd generated by lowering costs (or increasing benefits) will be more malleable than the one created in the absence of these external motivators: it will respond more strongly to

with certainty while the lottery treatment offered a probabilistic reward of R55, where participants did not know the probability itself. For the lottery treatment to supersede the free treatment in expected value, agents would have to assume a relatively high probability of lottery payout (greater than 1 in 275). As this is arguably an unrealistic assumption for most real-world lotteries, a strictly rational agent might respond more to the offer of free service. On the other hand, R0.2 is a trivial amount, even for relatively poor participants. Moreover, many prior studies in behavioral economics have shown that agents tend to over-weight small probabilities (Camerer 2004, Kahneman and Tversky 1979). For these reasons, a lottery, even or especially one without the odds given, may have a stronger effect on behavior. In any case, we treat this an empirical question.

[20] We do not control for demographics in this table because of data limitations. However, 100% of COs who provided demographic data were black. We also do not control for entry strata as virtually all of the actual observers came from the standard USSD treatment group.

further incentives.

Because the lottery treatment was the most effective at inducing participation, we focus our attention on this arm as unequivocally composed of more extrinsically motivated individuals than the standard arm. To test H3a, we employ a difference in differences design: the effect of incentivization should be larger for those who have already shown sensitivity to incentives. We exploit the fact that some Phase 2 questions were incentivized via lottery for all participants (the "Demographics" questions) while others were un-incentivized for all participants (What's up, VIP). We can look at the differential response rates to these two sets of questions for initially incentivized (Free and Lottery) and un-incentivized (Standard) groups to understand how recruitment incentives alter the differential efficacy of subsequent incentives. We expect the differential participation rate between incentivized and un-incentivized questions will be larger in the group that was recruited using extrinsic incentives than the group that was not.

Column (1) of Table 8 shows the Free and Lottery groups are about 8 points more likely than the Standard group to answer incentivized questions. Column (2) shows that the difference in the willingness to answer un-incentivized questions is either zero or very small relative to Standard. Consequently, when in Column (3) we show the difference in differences between incentivized and un-incentivized questions, both incentive treatments result in differential response rates on the order of 6.7 points (Free) to 8.4 points (Lottery), confirming H3a. Thus, the drivers of response rates to crowd-sourced data collection include not only contemporaneous incentives, but the history of incentives that has shaped that crowd over time. In this sense our evidence is doubly positive on the use of enrollment incentives (higher overall subsequent participation plus higher subsequent responsiveness to extrinsic incentives).

Column (4), Table 8 tests H3b; moving from digital forms of participation whose (low) costs vary across channels, to real-world forms of participation such as serving as a citizen observer whose (high) costs are less related to the technology used in recruitment. Once the cost of the action exceeded the differential costs across channels and across incentives, the differential participation probabilities generated in the recruitment process are no longer important in determining who engages in the real-world. We expect incentives for costly forms of participation to be effective across all channels, but not differentially so (because none of those induced by low net cost-to-participate digitally are engaged in the high-cost activity anyway). As predicted, Table 8, Column 4 shows the incentive is strongly effective in all three groups but not differentially so across initial recruitment arms once the cost of action becomes sufficiently high.

Overall, we find that by initially incentivizing a voluntary activity, we create a participant group that responds more favorably to subsequent incentives. In short, incentivization creates a positive feedback loop by selecting a set of participants that is subsequently more sensitive to these inducements. This is the"good news" of our fragile crowd: it is also a crowd that is easily directed through the use of incentives.

4.4 Comparative Cost Effectiveness

The central importance of participation is made concrete when we conduct a cost-benefit analysis of the platform relative to alternatives. We can use cost per successfully monitored polling station to yardstick our crowd-sourcing approach relative to standard and well-documented alternatives for election monitoring.[21] The rows of Appendix Table A-4 compare potential ways of scaling our platform nationally. Based on the results presented here, we simulate costs for three variants of platform: where all users are unincentivized, where all users are incentivized both in enrollment and in monitoring (thus creating the feedback loop described above), and a counterfactual scenario where all platform users who volunteered to monitor actually did so. To broaden the comparisons, we also provide costs from a parallel field exercise (not reported in this paper) where a local organization hired and trained South African monitors to observe stations using pen-and-paper techniques, and from Callen et al. (2016) with locally trained and paid monitors using a mobile-phone application and international election monitoring costs in Uganda.

The Appendix describes the costing exercise in greater detail, which we summarize here. The first column in Table A-5 shows the recruitment and training cost per user, where we amortize the platform development costs over the number of monitors that would have materialized had we run the entire national platform under each of these scenarios. The second column gives the number of stations to be monitored per individual, the third column the rate at which successful monitoring occurs, and the fourth column gives the final cost per station monitored. Low overall participation on an unincentivized platform makes the cost per station very high at more than \$7,000; incentives improve participation driving the cost per station to about \$5,400. However, under a counterfactual scenario in which all those who volunteered to monitor successfully did so, costs per user would fall to just \$166, slightly higher than the figure for our locally trained professional monitors (\$101) or similar local monitors employed in Uganda per Callen et al. 2016 at \$40, (but significantly cheaper than international monitors in Uganda at \$6,200).

The promise of crowd-sourcing to achieve mass coverage is seen in the last column of Table A-4, which shows a marginal cost per additional station of only \$15 once the VIP: Voice platform fixed costs are sunk, 85% lower than the marginal cost of professional monitors. Overall, the crowd-sourcing approach is not cost-effective with only a few monitored stations, but with viral adoption and as coverage of stations grows, citizen-based ICT observation achieves cost effectiveness relative to a similar scale of professional work either by local or international monitors. We read these results as suggesting that platforms such as VIP:Voice are best thought of as a way to supplement (rather than replace) structured user bases from non-governmental and international organizations.

[21] The comparison is somewhat unfair to our platform, which had a broader set of objectives than simply to get polling stations monitored. Because our platform yielded an unrepresentative sample of participants, we do not attempt to benchmark this type of crowd-sourcing as a survey tool.

5 Conclusion

This paper presents the results from our nationally-scaled ICT election platform built *de novo* to recruit participants across a variety of digital channels. Our study focuses on how digital participation interacts with engagement in real-world political activity. While recent research finds ICT interventions can increase political participation, few studies explore or test how the cost of technology can determine population of individuals who ultimately participate. Knowing *how* ICT attracts and retains certain types of participants and not others is critical to developing more effective ICT designs.

Despite impressive overall recruitment in VIP:Voice, we find attrition across time and activities forms a critical component to the story. Specifically, we find evidence that ICT-generated crowds are fragile and (dynamically) malleable. Observationally, we confirm those who intended to vote in the election at the time of registration are more likely to remain involved in our platform during the course of the electoral cycle, particularly as they are asked to engage in election-related activities with real-world costs. Smartphone-based platforms make digital communications easy and help to retain participants for activities such as entering information about themselves and local political events, but they also recruit a user-base that is particularly prone to attrite when asked to undertake costlier political actions, bearing out the fragility hypothesis.

Our experimental results provide theoretical insights and important policy implications for those concerned with improving democracy and governance in developing countries. First, intrinsic and extrinsic motives drive participation. Contrary to a literature suggesting that small extrinsic incentives may crowd out intrinsic motivation, we find relatively small financial inducements to be effective at every stage. This is particularly true of lotteries. Our results suggest a set of dynamic benefits of the initial use of incentives: the subsequent user group is larger in absolute size, no more recalcitrant when asked to do things for free, and more responsive to incentives on the margin. The incentive to observe tripled the probability that an individual entered usable voting data from their polling station. We therefore see little downside to these incentives in our data.

Second, our results inform discussions within the ICT community about the implications of technology channel choice. Starkly different demographic profiles across channels suggests there is no simple answer to the question "Can technology improve participation by under-represented groups?" Rather, the relevant question is: "Which blend of technologies will yield the final user profile that we want?"

Finally, our findings offer guidance on the practical possibility of using citizens as election observers reporting on political acts such as vote-buying or campaign violence. Indeed, ICT proves a useful tool for organizations already interacting with constituents in a wide variety of ways, including in health, banking, and agricultural sectors. But citizen participation has been a stumbling block in numerous ICT applications to date, most notably those that require action rather than simply passive absorption of information. We provide evidence on strategies to encourage citizen engagement with real-world political activities, including observing polling places, including insights on how cost-effectiveness is achieved at scale as monitored stations increase.

Ultimately, the transformative potential of ICT depends on how citizens use technology. We show that with appropriate channel choice, an ICT approach can achieve outreach far beyond the young, male demographic that dominate smartphone-based social media, broadening participation further using extrinsic incentives. Political engagement initiated in the digital realm *can* cross over to activity in the real-world. ICT can therefore play a central role increasing citizens' participation and their contribution to the quality of democracy.

However, ICT does more than simply raise participation levels. By affecting the costs of engagement, it determines who joins and acts and who does not, ultimately shaping the very nature of the participant crowd. Social movements that form in technological environments with high communication costs are are likely to differ in fundamental ways from social movements that form in technological environments in which communication costs are low. In the former case, we would anticipate high costs to deter all but the most committed true believers; in the latter, lower costs bring in a wider, and less uniformly committed, group of activists who are more sensitive to external inducements and less resilient to rising costs.

Table 1: Recruitment and Participation Numbers

	Mobile Phone Channels:		Feature Phone	Smartphone/ Social Media Channels:			
Phase 1 Recruitment	USSD Experiment	USSD Other	Mxit	Mobi	Twitter/ Gtalk	Advert/ Other	Total Total
Total # Solicited via PCM	49.8m		.	.	.	.	.
Total # Registered	40,166	4,277	40,416	4847	101	839	90,646
Registered as % of PCMs	0.08%						
Phase 2 Participation Waterfall							
Any Initiation	126,649	12,998	114,358	4,923	317	3,718	262,963
Any answer to Engagement Question	65,382	6,816	55,352	4,882	131	1,484	134,047
Registration (T&C) Initiated	52,049	5,426	50,862	4,867	119	1,135	114,458
Registration Completed	40,166	4,277	40,416	4,847	101	839	90,646
Registration & Demographics Completed	11,338	1,143	20,078	2,028	66	74	34,727
Reg, Demo, and Any Other Phase 2	3,859	367	10,215	995	23	2	15,461
Reg + Demo as % of Initiated:	8.952%	8.794%	17.56%	41.19%	20.820%	1.99%	13.21%
Reg + Demo as % of PCMs:	0.02%						
Phase 3 Monitoring Invitations.							
Invited to Volunteer as Monitor	35,242	3,885	10,823	877	33	135	50,995
Agreed & Provided All Information	1,775	212	462	51	5	2	2,507
Potential Monitors as % of Invited:	5.04%	5.46%	4.27%	5.82%	15.15%	1.48%	4.92%
Phase 3 Actual Monitoring.							
Asked to Monitor	1,817	50	0	5	0	27	1,899
Conducted Any Monitoring	331	9	1	1	0	8	350
Monitors as % of Actually Asked:	18.22%	18.00%	NA	20.00%	NA	29.63%	18.43%

Table 2: Participation, Controlling for Demographics

Outcome:	Number of Phase 2 Responses (other than Demographics)			Volunteers to Monitor in Phase 3		
Sample:	All	Demographic Data Observed		Volunteer Recruitment Sample	Volunteer Recruitment Sample, Demographic Data Observed	
	(1)	(2)	(3)	(4)	(5)	(6)
USSD	0.530	1.727	1.621	0.0507	0.103	0.0898
	(0.01)	(0.04)	(0.05)	(0.00)	(0.00)	(0.00)
Mxit	3.366	6.372	6.441	0.0425	0.0427	0.0492
	(0.03)	(0.05)	(0.06)	(0.00)	(0.00)	(0.00)
Mobi	0.255	0.766	0.688	0.0548	0.0630	0.0596
	(0.01)	(0.04)	(0.04)	(0.01)	(0.01)	(0.01)
Other:	0.372	2.966	2.897	0.152	0.152	0.138
Twitter, Gtalk	(0.07)	(0.57)	(0.57)	(0.06)	(0.06)	(0.06)
Age			0.0182			0.00246
			(0.01)			(0.00)
Male			−0.672			−0.000083
			(0.08)			(0.00)
Coloured			0.291			−0.0163
			(0.13)			(0.01)
White			0.156			−0.0264
			(0.29)			(0.01)
Asian			−0.484			0.00423
			(0.39)			(0.02)
Voted in 2009			−0.374			0.0112
Election			(0.08)			(0.00)
Engagement:			−0.364			−0.0115
too young to vote			(0.13)			(0.00)
Engagement:			0.0864			0.0156
Enthusiasm			(0.05)			(0.00)
N	90,646	30,170	30,170	50,814	18,781	18,781
R^2	0.217	0.404	0.407	0.049	0.08	0.089

OLS regression with robust standard errors. Columns 1-3 use the entire registered sample, while columns 4-6 use the entire sample invited to serve as Citizen Observers. Regressions include an exhaustive set of dummies for channel and no constant, so the coefficients in the first four rows give the average unconditional outcome in each cell. Individual covarieates are demeaned before interaction, so the coefficients on channels in columns 3, 6 give the outcome for a constant average individual type.

Table 3: Engagement by Channel

	Yes, every vote matters (1)	No but I'll vote anyway (2)	No so I'm not voting (3)	Not Registered (4)
USSD non-experimental	83.54%	8.59%	1.12%	6.75%
USSD Experimental	79.19%	9.05%	1.91%	9.84%
Mxit	66.92%	9.11%	7.26%	16.71%
Mobi	80.29%	6.53%	4.46%	8.72%
Twitter/GTalk	78.45%	9.25%	1.64%	10.66%

Cells give fraction of each channel (rows) that give each response to the engagement question *"It's election time! Do u think ur vote matters?"* (columns) from the VIP:Voice data among those who answered the question and were of voting age.

Table 4: Engagement and Participation

Sample:	**All**	**All Registered**		
Answer to question: "It's election time! "Do u think ur vote matters?"	Registered	Any Phase 2	Gave Demographics	Volunteered Phase 3
	(1)	(2)	(3)	(4)
Yes, every vote matters	0.693	0.455	0.384	0.0576
	(0.0016)	(0.0020)	(0.0020)	(0.0012)
No, but I'll vote anyway	0.609	0.433	0.362	0.0478
	(0.0045)	(0.0059)	(0.0057)	(0.0033))
Not Voting/Not Registered	0.669	0.460	0.397	0.0239
	(0.0033)	(0.0043)		
N	118,095	80,346	80,346	46,882
R^2	0.6810	0.4540	0.3840	0.0550
F-Test: Yes=No, Vote Anyway	308.4	13.43	12.76	7.861
p-value	0	0.000248	0.000355	0.00505
F-test: Not Voting = No, Vote Anyway	116	13.94	24.77	39.78
p-value	0	0.000189	0.000000647	2.87E-10

OLS regressions with robust Standard Errors. Regressions estimated with no intercept so coefficients give fraction of each initial engagement level (rows) that engage across phases of the project (columns). Estimated only on the sample that answered engagement question other than 'skip' or 'too young to vote'. Column (1) estimated in entire remaining sample, and columns 2-6 estimated in remaining sample that also registered for the VIP:Voice platform.

Table 5: PCM Recruitment Experiment

Phase 1 Recruitment.	USSD Standard	USSD Free	USSD Lottery
Total # Solicited via PCM	13.8m	16.1m	19.9m
Total # Registered	7,258	8,146	24,762
Registered as % of PCMs	0.0526%	0.0506%	0.1244%

Table 6: Impact of Incentives on Volunteering to Observe
Volunteers to Monitor in Phase 3

	All	All with Demographics	
	(1)	(2)	(3)
Incentivized to Monitor	0.0158	0.0157	0.0160
	(0.00)	(0.00)	(0.00)
USSD Free	0.0273	0.127	0.124
	(0.00)	(0.02)	(0.02)
USSD Lottery	0.0149	0.0568	0.0513
	(0.00)	(0.01)	(0.01)
USSD non-experimental	0.0189	0.0740	0.0661
	(0.00)	(0.02)	(0.02)
Mxit	0.00693	0.000676	0.0117
	(0.00)	(0.01)	(0.01)
Mobi	0.0182	0.0168	0.0211
	(0.01)	(0.02)	(0.02)
Twitter/Gtalk/Other	0.116	0.110	0.109
	(0.06)	(0.06)	(0.06)
Age			0.00262
			(0.00)
Male			-0.0000203
			(0.00)
Coloured			-0.0160
			(0.01)
White			-0.0270
			(0.01)
Asian			0.00503
			(0.02)
Voted in 2009 Election			0.0156
			(0.00)
Constant (average in USSD Standard)	0.0274	0.0330	-0.0399
	(0.00)	(0.01)	(0.01)
Observations	50,814	18,781	18,781
R-squared	0.003	0.024	0.031

OLS regressions with robust Standard Errors, regression estimated within the sample sent invitations to volunteer as Citizen Observers.

Table 7: Impact of Incentives on Actual Citizen Observing

	Monitoring Performed	Entered usable Vote data, whole sample	Entered usable Vote data, among those who responded
	(1)	(2)	(3)
Incentivized to Monitor	0.098	0.027	0.104
	(0.017)	(0.006)	(0.031)
Outcome in Unincentivized Group	0.120 (0.012)	0.005 (0.003)	0.042 (0.020)
Number of Observations	1,830	1,830	322

OLS regressions with robust Standard Errors, regression estimated within the sample actually invited to serve as Citizen Observers.

Table 8: Differential Impact of Subsequent Incentives on Participation

	Answers Survey Questions on Entry into System:			
	Answers Incentivized Questions	Answers Unincentivized Questions	Differential Probability (Incentivized - Unincentivized)	Volunteers to Monitor
	(1)	(2)	(3)	(4)
"Free" Treatment	0.0787	0.0187	0.0670	0.0185
	(0.007)	(0.004)	(0.007)	(0.005)
"Lottery" Treatment	0.0819	-0.003	0.0839	-0.001
	(0.006)	(0.003)	(0.005)	(0.004)
Incentivized to Monitor				0.0227
				(0.006)
Monitor Incent * "Free"				-0.013
				(0.008)
Monitor Incent *"Lottery"				0.000
				(0.007)
Constant (Control mean)	0.219	0.0588	0.186	0.0393
	(0.005)	(0.003)	(0.005)	(0.004)
Number of observations	40,336	40,336	40,336	35,377
R-squared	0.005	0.001	0.005	0.003
F-test: Free = Lottery	0.311	43.340	9.158	20.040
Prob >F	0.577	0.000	0.002	0.000

OLS regressions with robust SEs. All regressions use only the sample experimentally recruited in to USSD by PCM.

References

Aker, Jenny C. 2010. "Information from markets near and far: Mobile phones and agricultural markets in Niger." *American Economic Journal: Applied Economics* 2(3):46–59.

Aker, Jenny C, Christopher Ksoll and Travis J Lybbert. 2012. "Can mobile phones improve learning? Evidence from a field experiment in Niger." *American Economic Journal: Applied Economics* pp. 94–120.

Aker, Jenny C and Isaac M Mbiti. 2010. "Mobile phones and economic development in Africa." *Journal of Economic Perspectives* 24(3):pp. 207–232(26).

Aker, Jenny C and Marcel Fafchamps. 2010. "How does mobile phone coverage affect farm-gate prices? Evidence from West Africa." *University of California, Berkeley. http://www. aeaweb. org/aea/2011conference/program/retrieve. php* .

Aker, Jenny C, Paul Collier and Pedro C Vicente. 2011. "Is information power? Using cell phones during an election in Mozambique." *Document présenté à School of Business and Economics, Universidade Nova de Lisboa* 20:http://www.iig.ox.ac.uk/output/presentations/pdfs/iiG–E72–CellPhonesElectionMozambique.pdf.

Alexander, Peter. 2010. "Rebellion of the poor: South Africa's service delivery protests – a preliminary analysis." *Review of African Political Economy* 37(123):25–40.

Alozie, Nicholas O, Patience Akpan-Obong and William A Foster. 2011. "Sizing up information and communication technologies as agents of political development in sub-Saharan Africa." *Telecommunications Policy* 35(8):752–763.

Bailard, Catie Snow. 2009. "Mobile phone diffusion and corruption in Africa." *Political Communication* 26(3):333–353.

Bailard, Catie Snow. 2012. "A field experiment on the Internet's effect in an African election: Savvier citizens, disaffected voters, or both?" *Journal of Communication* 62(2):330–344.

Bailard, Catie Snow and Steven Livingston. 2014. "Crowdsourcing Accountability in a Nigerian Election." *Journal of Information Technology & Politics* 11(4):349–367.

Baird, Sarah J, Richard S Garfein, Craig T McIntosh and Berk Ozler. 2012. "Effect of a cash transfer programme for schooling on prevalence of HIV and herpes simplex type 2 in Malawi: a cluster randomised trial." *The Lancet* 379(9823):1320–1329.

Benabou, Roland and Jean Tirole. 2003. "Intrinsic and extrinsic motivation." *The Review of Economic Studies* 70(3):489–520.

Blanco, Mariana and Juan F Vargas. 2014. "Can SMS Technology Improve Low Take-up of Social Benefits?" *Peace Economics, Peace Science and Public Policy* 20(1):61–81.

Blumenstock, Joshua, Nathan Eagle and Marcel Fafchamps. 2016. "Motives for Mobile Phone–Based Giving: Evidence in the Aftermath of Natural Disasters." *Journal of Development Economics* .

Bratton, Michael. 2013. "Briefing: Citizens and cell phones in Africa." *African Affairs* 112(447):304–319.

Bratton, Michael, Robert B Mattes and Emmanuel Gyimah-Boadi. 2005. *Public opinion, democracy, and market reform in Africa*. Cambridge University Press.

Breuer, Anita, Todd Landman and Dorothea Farquhar. 2015. "Social media and protest mobilization: Evidence from the Tunisian revolution." *Democratization* 22(4):764–792.

Callen, Michael, Clark Gibson, Danielle F. Jung and James D. Long. 2016. "Improving Electoral Integrity with Information and Communications Technology." *Journal of Experimental Political Science* 3(1):4–17.

Callen, Michael and James D Long. 2015. "Institutional corruption and election fraud: Evidence from a field experiment in Afghanistan." *The American Economic Review* 105(1):354–381.

Callen, Michael Joseph, Saad Gulzar, Syed Ali Hasanain and Muhammad Yasir Khan. 2013. "The political economy of public employee absence: Experimental evidence from Pakistan." *Available at SSRN 2316245* .

Camerer, Colin F. 2004. "Prospect theory in the wild: Evidence from the field." *Advances in Behavioral Economics* pp. 148–161.

Cecchini, Simone and Christopher Scott. 2003. "Can information and communications technology applications contribute to poverty reduction? Lessons from rural India." *Information Technology for Development* 10(2):73–84.

Chang, Larry W, Joseph Kagaayi, Hannah Arem, Gertrude Nakigozi, Victor Ssempijja, David Serwadda, Thomas C Quinn, Ronald H Gray, Robert C Bollinger and Steven J Reynolds. 2011. "Impact of a mHealth intervention for peer health workers on AIDS care in rural Uganda: a mixed methods evaluation of a cluster-randomized trial." *AIDS and Behavior* 15(8):1776–1784.

Chi, Benjamin H and Jeffrey SA Stringer. 2010. "Mobile phones to improve HIV treatment adherence." *The Lancet* 376(9755):1807–1808.

Collier, Paul and Pedro C Vicente. 2014. "Votes and violence: evidence from a field experiment in Nigeria." *The Economic Journal* 124(574):F327–F355.

Dal Bó, Ernesto, Frederico Finan and Martín A Rossi. 2013. "Strengthening state capabilities: The role of financial incentives in the call to public service*." *The Quarterly Journal of Economics* 128(3):1169–1218.

Dammert, Ana C, Jose C Galdo and Virgilio Galdo. 2014. "Preventing dengue through mobile phones: evidence from a field experiment in Peru." *Journal of Health Economics* 35:147–161.

DeRenzi, Brian, Gaetano Borriello, Jonathan Jackson, Vikram S Kumar, Tapan S Parikh, Pushwaz Virk and Neal Lesh. 2011. "Mobile Phone Tools for Field-Based Health care Workers in Low-Income Countries." *Mount Sinai Journal of Medicine: A Journal of Translational and Personalized Medicine* 78(3):406–418.

Dunning, Thad. 2012. *Natural experiments in the social sciences: a design-based approach.* Cambridge University Press.

Dupas, Pascaline. 2014. "Getting essential health products to their end users: Subsidize, but how much?" *Science (New York, NY)* 345(6202):1279.

Fafchamps, Marcel and Bart Minten. 2012. "Impact of SMS-based agricultural information on Indian farmers." *The World Bank Economic Review* 26(3):383–414.

Ferree, Karen. 2011. *Framing the race in South AFrica: the political origins of racial census elections.* Cambridge University Press.

Ferree, Karen and James D. Long. 2016. "Gifts, Threats, and the Secret Ballot in Africa." *African Affairs* 115(461):621–645.

Findley, Michael G, Madeleine C Gleave, Robert N Morello and Daniel L Nielson. 2012. Extrinsic, intrinsic, and social incentives for crowdsourcing development information in uganda: A field experiment. In *WebSci'13 Proceedings of the 5th Annual ACM Web Science Conference.* pp. 326–35.

Gagné, Marylène and Edward L Deci. 2005. "Self-determination theory and work motivation." *Journal of Organizational Behavior* 26(4):331–362.

Gans-Morse, Jordan, Sebastian Mazzuca and Simeon Nichter. 2014. "Varieties of clientelism: Machine politics during elections." *American Journal of Political Science* 58(2):415–432.

Gneezy, Uri and Aldo Rustichini. 2000. "Pay enough or don't pay at all." *Quarterly Journal of Economics* pp. 791–810.

Grossman, Guy, Macartan Humphreys and Gabriella Sacramone-Lutz. 2014. ""I wld like u WMP to extend electricity 2 our village": On Information Technology and Interest Articulation." *American Political Science Review* 108(03):688–705.

Hellström, Johan and Anna Karefelt. 2012. Participation through mobile phones: A study of SMS use during the Ugandan general elections 2011. In *Proceedings of the fifth international conference on information and communication technologies and development.* ACM pp. 249–258.

Hyde, Susan D. 2011. *The Pseudo-Democrat's Dilemma: Why Election Monitoring Became an International Norm.* Cornell University Press.

Ichino, Nahomi and Matthias Schündeln. 2012. "Deterring or Displacing Electoral Irregularities? Spillover Effects of Observers in a Randomized Field Experiment in Ghana." *The Journal of Politics* 74(01):292–307.

Isbell, Linda M and Robert S Wyer. 1999. "Correcting for mood-induced bias in the evaluation of political candidates: The roles of intrinsic and extrinsic motivation." *Personality and Social Psychology Bulletin* 25(2):237–249.

Jack, William and Tavneet Suri. 2014. "Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution." *The American Economic Review* 104(1):183–223.

Jensen, Robert. 2007. "The digital provide: Information (technology), market performance, and welfare in the South Indian fisheries sector." *The Quarterly Journal of Economics* pp. 879–924.

Johnson, R.W. and Lawrence Schlemmer, eds. 1996. *Launching Democracy in South Africa: the first open election, April 1994*. Yale University Press.

Kahneman, Daniel and Amos Tversky. 1979. "Prospect theory: An analysis of decision under risk." *Econometrica: Journal of the Econometric Society* pp. 263–291.

Kasara, Kimuli and Pavithra Suryanarayan. 2015. "When do the rich vote less than the poor and why? Explaining turnout inequality across the world." *American Journal of Political Science* 59(3):613–627.

Kelley, Judith Green. 2012. *Monitoring democracy: When international election observation works, and why it often fails*. Princeton University Press.

Kramon, Eric. 2009. *Vote-buying and political behavior: Estimating and explaining vote-buying's effect on turnout in Kenya*. Institute for Democracy in South Africa.

Kuenzi, Michelle and Gina MS Lambright. 2010. "Who votes in Africa? An examination of electoral participation in 10 African countries." *Party Politics* p. 1354068810376779.

Lester, Richard T, Paul Ritvo, Edward J Mills, Antony Kariri, Sarah Karanja, Michael H Chung, William Jack, James Habyarimana, Mohsen Sadatsafavi, Mehdi Najafzadeh et al. 2010. "Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WelTel Kenya1): a randomised trial." *The Lancet* 376(9755):1838–1845.

Lodge, T. 1983. *Black politics in South Africa since 1945*. Longman Publishing Group.

Lodge, Tom and Bill Nasson. 1991. *All, here, and now: Black politics in South Africa in the 1980s*. New Africa Books.

Morozov, E. 2011. *The net delusion: the dark side of internet freedom*. Public Affairs.

Nichter, Simeon. 2008. "Vote buying or turnout buying? Machine politics and the secret ballot." *American Political Science Review* 102(01):19–31.

Nie, Norman H, Jae-on Kim and Sidney Verba. 1978. *Participation and political equality: A seven-nation comparison*. University of Chicago Press.

Pierskalla, Jan H and Florian M Hollenbach. 2013. "Technology and collective action: The effect of cell phone coverage on political violence in Africa." *American Political Science Review* 107(02):207–224.

Plaut, Martin and Paul Holden. 2012. *Who Rules South Africa?* Biteback Publishing.

Pop-Eleches, Cristian, Harsha Thirumurthy, James P Habyarimana, Joshua G Zivin, Markus P Goldstein, Damien De Walque, Leslie Mackeen, Jessica Haberer, Sylvester Kimaiyo, John Sidle et al. 2011. "Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: a randomized controlled trial of text message reminders." *AIDS (London, England)* 25(6):825.

Powell Jr, G Bingham. 1980. "Voting turnout in thirty democracies: Partisan, legal, and socio-economic influences." *Electoral participation: A comparative analysis* 534.

Reynolds, Andrew, ed. 1994. *Election '94 South Africa: the campaigns, results and future prospects*. St. Martin's Press.

Schulz-Herzenberg and Roger Southall, eds. 2014. *Elections 2014 South Africa: the campaigns, results and future prosepects*. Jacana Media.

Shapiro, Jacob N and Nils B Weidmann. 2015. "Is the Phone Mightier Than the Sword? Cellphones and Insurgent Violence in Iraq." *International Organization* 69(02):247–274.

Shirazi, Farid. 2008. "The contribution of ICT to freedom and democracy: An empirical analysis of archival data on the Middle East." *The Electronic Journal of Information Systems in Developing Countries* 35.

Southall, Roger. 2014. "Zuma: party leadership as electoral liability." *Nelson Mandela and the political economy of unfinished liberation* http://www.tandf.co.uk/journals/pdf/spissue/crea-si-southall.pdf.

Stokes, Susan C. 2005. "Perverse accountability: A formal model of machine politics with evidence from Argentina." *American Political Science Review* 99(3):315.

Suarez, Sandra L. 2006. "Mobile democracy: Text messages, voter turnout and the 2004 Spanish general election." *Representation* 42(2):117–128.

Tufekci, Zeynep and Christopher Wilson. 2012. "Social media and the decision to participate in political protest: Observations from Tahrir Square." *Journal of Communication* 62(2):363–379.

Van der Windt, Peter and Macartan Humphreys. 2014. "Crowdseeding conflict data." *Journal of Conflict Resolution* .

Wolfinger, Raymond E and Steven J Rosenstone. 1980. *Who votes?* Yale University Press.

World Bank. 2014. "Mobile cellular subscriptions.". data retrieved from World Development Indicators, `http://data.worldbank.org/indicator/IT.CEL.SETS.P2`.

Appendices

Table A-1: Expected Recruitment by Channel

Advertising Channel	**Interaction Channel**	**Expected Impressions**	**Expected Recruitment**
Mxit broadcast messages & splash page ads	Mxit	3,900,000	78,000
Mobi banner ads	Mobi	26,000,000	7,200
Google adwords	Mobi	550,000	15,000
Promoted tweets and accounts	Twitter	1,980,000	15,000
Facebook page posts	Facebook	5,000,000	45,000
Please Call Me (PCM) messages	USSD	20,000,000	200,000
Live Magazine SA Google+ posts	Google+	67,000	1,500
Live Magazine print ads	All Channels	60,000	1,000
Total		**57,557,000**	**362,700**

Table A-2: Demographics of Participants, by Channel

	Age	Male	Black	Coloured	White	Asian	Voted in 2009
National Average	24.9	0.51	0.792	0.0892	0.0886	0.0249	77.30%
Platform Average	23.995	0.510	0.858	0.102	0.010	0.018	38.51%
SE	6.90	0.50	0.35	0.30	0.10	0.13	0.49
By Channel:							
USSD	26.148	0.350	0.937	0.040	0.009	0.005	57.32%
SE	7.91	0.48	0.24	0.19	0.10	0.07	0.49
Mxit	22.764	0.622	0.816	0.137	0.023	0.013	28.15%
SE	5.92	0.48	0.39	0.34	0.15	0.11	0.450
Mobi	23.718	0.350	0.890	0.056	0.015	0.007	46.46%
SE	6.72	0.48	0.31	0.23	0.12	0.09	0.50
Twitter/GTalk	25.453	0.485	0.639	0.098	0.131	0.115	40.6%
SE	5.98	0.50	0.48	0.30	0.34	0.32	0.50

National average data come from the 2011 South African Census. Remaining cells give the averages among the sample that entered under each platform/status *and* answered the demographic questions in the platform. First row gives the means and the second row gives the Standard Errors.

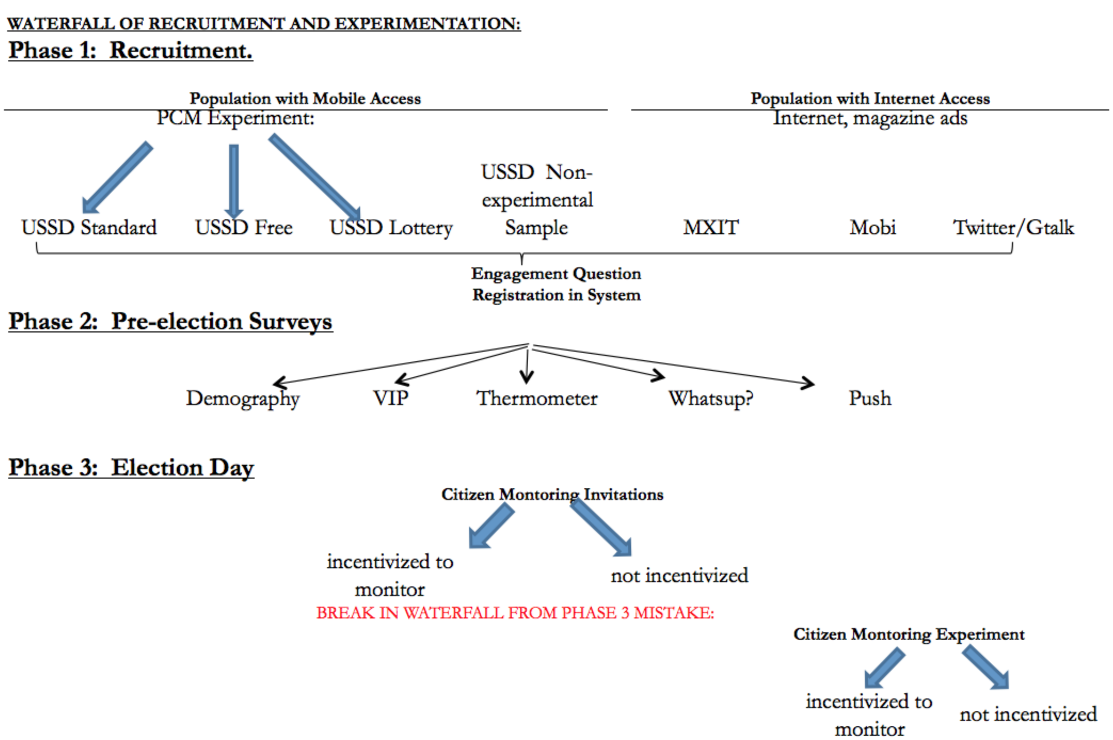

Figure A-1: Waterfall of Recruitment and Experimentation

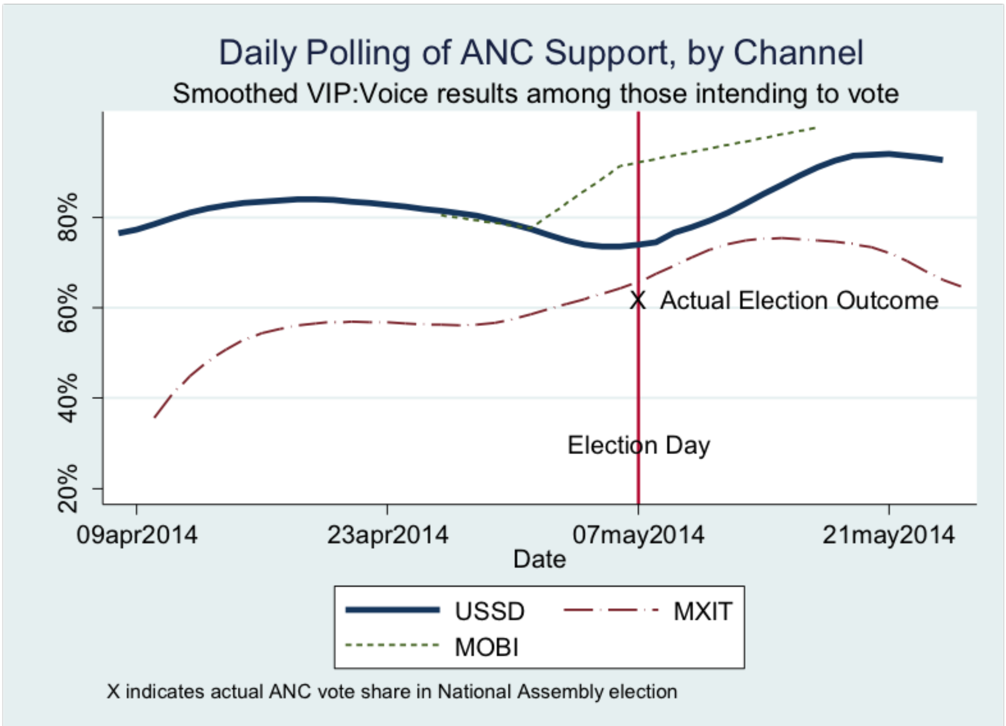

Figure A-2: Daily Opinion Polling

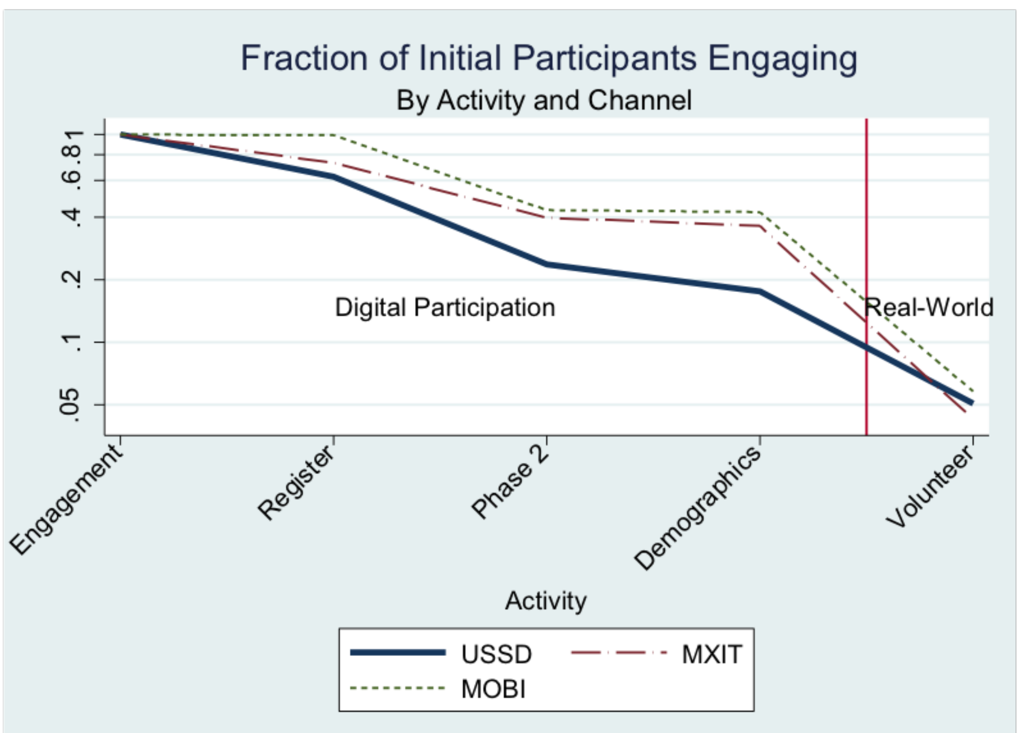

Figure A-3: Participation Rates by Activity and Channel

Table A-3: Balance of the Phase 3 incentives experiment as actually performed:

Variables	Engagement: No Vote Anyway	Engagement: Yes Vote	Any Phase 2 Responses	Any 'What's up' Responses	Any Responses	Any Demographics	Age	Male	Voted in 2009	Volunteered Phase 3
Actually Incentivized	0.040	0.055	0.017	0.003	0.001	0.011	0.773	0.032	0.034	0.00138
to Monitor	(0.025)	(0.035)	(0.015)	(0.003)	(0.005)	(0.013)	(1.325)	(0.076)	(0.086)	(0.006)
Constant	0.151	0.614	0.102	0.00374	0.00998	0.0773	26.20	0.290	0.607	0.0137
	(0.020)	(0.027)	(0.011)	(0.002)	(0.004)	(0.009)	(0.980)	(0.058)	(0.066)	(0.004)
Observations	792	792	1862	1862	1862	1862	145	155	138	1862
R-squared	0.003	0.003	0.001	0	0	0	0.002	0.001	0.001	0

While most South Africans may not be users of social media platforms, cell phone saturation was almost 90% in the previous census and has risen to almost 100% since. Feature phones and smartphones (which can access the web) currently have a saturation rate of 70%. To set the stage of the populations that could be reached using mobile phone and internet channels, Table A-4 uses ward-level data from the census to describe how mobile penetration (average 89%) and internet access (average 25%) vary with the political and demographic features of the ward.

Table A-4: National Mobile Phone and Internet Penetration Rate

	coef (SE)	coef (SE)
ANC Vote Share	−0.020	−0.044
	(0.005)	(0.006)
DA Vote Share	0.030	−0.035
	(0.009)	(0.01)
Pop ('000)	−0.001	−0.004
	(0.00)	(0.00)
Pop under 25 ('000)	0.006	0.013
	(0.001)	(0.001)
Fraction Male	0.200	0.030
	(0.018)	(0.021)
Frac Black	0.119	0.084
	(0.009)	(0.01)
Frac Coloured	0.021	0.053
	(0.006)	(0.008)
Frac English Speaking	−0.003	0.091
	(0.006)	(0.008)
Frac w/ HS Diploma	0.244	0.211
	(0.011)	(0.015)
Frac w/ Electricity	0.083	−0.001
	(0.005)	(0.004)
Frac w/ Computers	0.026	0.518
	(0.015)	(0.016)
Frac w/ Internet Access	0.064	
	(0.012)	
Constant	0.513	0.012
	(0.012)	(0.014)
Number of observations	4,276	4,276
Mean of Dep Var:	0.888	0.248

OLS regressions using census data at the ward level on all wards in South Africa, weighted by ward-level population to be nationally representative.

Comparative Cost Effectiveness

Table A-5 presents the results of an effort to compare the cost-effectivness of different modalities in producing monitored polling places (defined as an observer visiting a station and recording data per Phase 3). First, we calculate a cost per citizen who volunteers and performs any kind of monitoring with VIP:Voice, including those who were and were not incentivized to do so. We calculate a cost per invited observer on our platform by multiplying the number of volunteer citizen observers (2,507) times the rate at which those whom we invited to monitor did so (12% and 22% for unincentivized and incentivized observers, respectively, Table 8) to calculate the number of citizens who would have agreed to monitor if all who had volunteered had been invited. We then apportion the total VIP:Voice costs ($420,507), which aggregates platform development ($383,256) and media costs ($37,251), to these citizen monitors' share of the total cost in column (1), and include the cost of the incentive ($4) in the second row. The second row also takes the higher response rate to incentives into account. In column (3), we adjust for the fact that a relatively small share of those who did any election reporting entered machine-readable vote totals.[22] The rate of correct data entry also responded to incentives. Comparing the first two rows, we see that because incentivization is relatively cheap ($4 per monitor) and effective at increasing response rates, the use of incentives drops the cost per monitored station from $7,635 to $5,384. In the third row we conduct a counterfactual exercise to isolate the role played by low response rates in generating high per-station costs. We assume that every respondent who volunteered to monitor had done so successfully. In this case the cost per station falls dramatically by 97%, to $166. This exercise demonstrates that a key issue for cost effective citizen monitoring is compliance. If everyone who volunteered actually showed up and completed the task, costs per monitored station would be low.

In the fourth row of A-5, we compare the full compliance counterfactual to an alternative monitoring strategy by exploiting data from a parallel study in which we worked with a South African non-governmental organization to hire and train 180 local college students for election monitoring.[23] We note a few important differences in this design compared to citizens. First, data capture was significantly easier for these observers because they used pen and paper in addition to digital photos of tallies. Second, they received light training and deployment to an average of 3.3 stations to monitor, allowed by their accreditation as observers,[24] in addition to reimbursement of travel expenses and two days' wages.

To directly compare these non-governmental observers (which we term 'ICT-enabled Local Monitors') to citizens, we first we treat the local monitors as if they were a part of VIP:Voice and used the platform for monitoring. Apportioning a share of platform development costs to these 'ICT-enabled Local Monitors,' we calculate a per-monitor cost of $294, including the higher costs of training and employing these individuals. Comparing per station costs, citizen observers with full compliance are more cost effective.[25]

We provide two final points of reference by comparing the full compliance counterfactual to results from Uganda as given in (Callen et al. 2016) to international monitors.[26] They report the per-station costs for professional monitors based on the European Union Election Observation Mission to the country ($6,220), as well as for ICT-enabled local monitors using a simpler, feature phone-based election monitoring system ($40). Direct comparison of these two monitoring exercises is difficult as international observers appear to adhere (or deviate from) different assignment strategies and rates (Hyde 2007, 2011), and do not typically make their data recorded from individual polling stations available to assess quality. But, for comparison purposes and assuming internationals had perfect compliance with the per station cost in Uganda, citizen monitors in South Africa are 97% cheaper than internationals, assuming full compliance by citizens. Variable compliance rates on the part of citizens and international observers therefore make any direct comparisons difficult, but compliance is a core issue to cost-effectiveness for any monitoring approach, including citizens.

A final comparison is warranted with respect to scaling by comparing the three modalities in terms of the marginal cost of increasing monitored polling stations. An important difference between a brick and mortar approach like international or local monitors compared to ICT-enabled citizens comes at the marginal cost of increasing an additional monitor for each approach, or "low-cost" scaling. For traditional programs, the additional cost of an extra station is a linear cost increase at a fixed (and high) amount: adding one more station incurs a fixed cost that is essentially the same at any level of stations as the cost of the first station.

[22]Most of the difficulty in data capture and transfer in this instance can be attributed to the fact that we asked citizens to take pictures of tallies, many of which were missing or misplaced (in contravention of electoral guidelines), as well as platform features of VIP:Voice that were not designed to receive photo transmission easily. If tallies were more consistently posted and platform design features improved, we would expect a dramatic increase in the quantity and quality of data.

[23]These students had no prior experience.

[24]Assigned polling stations were known to the observers, but not any electoral officials, before election day.

[25]Unlike citizen observers, local monitors are able to visit an average of 3.3 stations per individual, and hence turn out to be 40% more efficient overall, with an effective per-station cost of just over $100. Therefore, in a full compliance world, the cost effectiveness of 'ICT-enabled Local Monitors' compared to citizens comes from their ability to observe at multiple polling stations.

[26]South Africa no longer features international missions that observe elections nation-wide, so a direct comparison is not possible.

Therefore, pricing out costing for scaling is a function of how many stations an organization wants to visit. However, for an ICT-platform, once a fixed cost is paid, the marginal increase declines as the number of stations increases. To assess the marginal cost of increasing stations for VIP: Voice, we note that the cost to monitor one station would be the cost of the platform, or \$383,256. The marginal rate of increase, once we subtract out platform development (which would be held constant regardless of the number of users), declines as a function of media costs and incentivization. Therefore, we recalculate in Table A-5, row 3, the increase of a monitored station by citizens with only media and incentive costs and perfect compliance. This yields a per station cost of \$14.69. This amount would further decline as more stations are added, subject to a constant additional \$4 for incentivization. Therefore, what shapes the marginal rate of increase for additional stations differs across monitoring type. Whereas ICT-based citizen monitoring carries significant fixed costs in terms of platform development and therefore is not cost effective for only a few monitors, it becomes significantly more cost effective at scale compared to traditional monitoring programs. Obtaining cost effectiveness through low-cost scaling underscores the importance of ICT monitoring, and ICT platforms could incorporate, rather than substitute, reports from local and international monitors.

Monitoring Modality	Recruitment & Training Cost per Monitor	Number of Stations per Monitor	Fraction of Stations Effectively Monitored	Cost per Effectively Monitored Station	Marginal Cost of Additional Station
South Africa:					
Citizen Monitors, unincentivized	$1,381.50	1	4.2%	$7,635.42	
Citizen Monitors, incentivized	$764.46	1	14.2%	$5,383.52	
Citizen Volunteers, if perfect compliance rate	$165.78	1	*100.0%*	*$165.78*	$14.69
ICT-enabled Local Monitors	$293.99	3.3	88.0%	$101.24	$101.24
Uganda (Callen et al. 2015):					
Traditional Professional Monitors				$6,220.00	
CT-enabled Local Monitors				$40.00	

Note: the South Africa results provide cost estimates from our data. The cost of a Citizen Volunteer is calculated by multiplying the number of volunteer monitors times the rate at which those we invited to monitor to calculate the number of successful citizen monitors we would have yielded if all were invited under each treatment status. We then apportion the total platform development costs ($420,507) to these citizen monitors' share of the development cost to get column (1). The third row is a counterfactual exercise assuming that every volunteer citizen monitor was able to effectively monitor the station. The fourth row uses numbers from a parallel experiment in which we worked with a non-governmental organization to train local college students to use the platform for election monitoring (these monitors were paid and had expenses reimbursed). The Uganda results are from Callen et al. (2016), and report the costs for international monitors based on the European Union Election Observation Mission to the country, and for ICT-enabled local recruits are based on the use of a simpler, feature phone-based election monitoring system.

Table A-5: Comparative Cost Effectiveness