

Manuscript for special edition of Journal of ITID on "HCI and International Development"

Title: "Mobile Phone Use and Users in Rural Africa: Findings from a Kenyan Village"

Abstract

A village in western Kenya is the setting for a unique case study of mobile phone uses in an agrarian, low-income setting where handset ownership is still low, at 15% of households (according to original project data). Fieldwork in 2007 comprised a comprehensive household survey of a large community, plus in-depth interviews, group discussions, and participant observation. Mobile phones are indeed being rapidly and eagerly adopted into the lives of diverse rural residents: farm-bound housewives, community organizers, itinerant traders, urban shopkeepers, and white-collared villagers find ordinary communications easier. Distinctions between individual, personal, household economic, and communal uses are blurred. Phones replace inconvenient and expensive technologies (foot, bicycle, bus, post, landline) and complement other technologies, including the ox-drawn plough and hand-hoe, still vital to food and livelihood security. These communications are costly, in part because voice calls are much preferred in this oral culture over texts, and airtime and charging are expensive, but considered an improvement over alternatives. Handset purchase price, airtime and charging costs, and lack of electricity are still major problems for even the better-off and more educated rural residents. By mid-2008, less than half of phone owners originally interviewed in early 2007 could be reached on their original number owing to difficulties in keeping SIM cards active and phone batteries charged. Mobile phones are indeed finding an enthusiastic welcome in this village as in other communities in rural and urban Sub-Saharan Africa, but chronic deprivations pose barriers to more widespread ownership as well as to more effective and economical use of mobile phones in underserved areas. Methodological and practical insights are shared that arise from this multi-method case study design.

keywords

mobile phones. livelihoods. technology. adoption. owners. users. agriculture. rural Africa. social science. case study

I. Introduction and background

Observers note the rapid increase in recent years of mobile phone subscriptions around the globe, which are predicted to reach 4 billion; the rise in subscriptions across the African continent has been particularly rapid (ITU, 2008). Unlike earlier generations of information and communication technologies (ICTs), mobile phones are finding their ways into urban, rural, and pastoral places which are home to the “bottom of the pyramid”—the poorest consumers around the world. Mobile phones can evidently improve rural incomes, improve food security, facilitate emergency responses, strengthen health information systems, and boost the economies of nations, through facilitating financial transactions and flows, and strengthening social ties. Academic studies of phone ownership and use that inform these judgements around the impacts of mobile phones in the developing world are scarce, but reveal some of these wide-ranging impacts for women in India (Zainudeen, 2006), Rwandan small businessmen (Donner, 2005), ordinary Tanzanians and South Africans (Samuel, et al 2005; Souter et al 2005, Vodaphone 2005), and Indian fishermen (Jensen 2007). Many studies specifically emphasize the economic potential and impacts (i.e., Jensen, 2007, Waverman et al 2005), but personal, social and non-economic uses are recognized as popular and valued uses among the poorest in Jamaica, where phones are nearly universal (Horst and Miller, 2006) as well as in rural Tanzania, where mobiles were until recently, rare (Sameul et al 2005, Goodman 2005).

These survey findings, observations, and anecdotes of artisanal fishermen, smallholder farmers, street hawkers, and small businesses--combined with remarkable statistics on global subscribership--suggest that mobile phones are by now reaching everyone, everywhere. This Kenyan village case study, however, reveals (as other studies suggest) that ownership as well as uses of mobiles is biased towards the better off and more education, reflecting social and economic inequalities present at every level of society. Rather than promoting balanced development, phones might in fact perpetuate inequities, as research among Zambian phone owners suggests (Wakunuma, 2007). Not just further sales of handsets and subscriber lines, but their effective, convenient, and economical use by the poorest in rural Africa, is hampered by persistent social, economic and infrastructural inequalities.

While the body of academic and applied research on this explosive technology is growing, and pilot studies can suggest the answers: we still know little about the burgeoning population of new owners and users around the world: Who are they in rural Africa, where farming remains the mainstay, and the vagaries of weather dominate lives? How do they actually use their phones, i.e., what functions and for what purposes? What problems do they face in using their phones? Do mobile phones enable new forms of livelihoods for rural residents? What can the experiences of these owners and non-owners (including partial-users, non-users, and hope-to-be-users) tell us about how to make mobile phones more effective tools for the rural poor?

This small study from one location in western Kenya aims to help address these questions to help advance the ICT4D agenda. The article is thus targeted

to technical experts, designers, practitioners, and policy-makers eager to leverage mobile phones and other information and communication technologies for development.

The article is organized as follows: Section II introduces the research approach and study site in western Kenya. Section III describes findings around ownership, users, and problems. Section IV discusses key findings about rural users and uses, and highlights major problems that emerged in this case study location. Section V draws a few final conclusions and suggests some implications of this case study for development practise and further research. In particular, a geographically defined catchment area and a mix of methods can complement other research using snowball sampling, population-based surveys, or targeted observation of specific technologies.

II. Research Approach and Study Site

Fieldwork was undertaken from January through July 2007 in Bungoma District in western Kenya (Endnotes 1, 2). A village census (3, 4) from February to March 2007 documented the entire large catchment area. The household survey gathered information from 848 households (878 households were listed, only 29 did not respond). Data were gathered on current household members, and their age, sex, education, work activities, health status, phone ownership, as well as household livelihood activities, crops, and assets. For all households, an additional structured individual interview (5) with an adult gathered information on handsets, service providers, functions, recent calls, estimates of cash expenses on airtime and charging, perceived benefits, and problems (for owners) and uses, perceptions and barriers to ownership and use among non-owners. The village census is thus the first comprehensive, representative survey of phone use for a given geographic catchment area in rural sub-Saharan Africa, in contrast to other quasi-random, snowball, or judgement samples in rural and peri-urban areas which tend to be biased towards phone owners (i.e., Samuel et al 2005; Donner et al 2005; Souter et al 2005)

Furthermore, group discussions (endnote 6) were held with male and separately female owners or users recruited from the village. Semi-structured In-depth individual (IDI) interviews (7) were held with 16 adults selected to represent male/female, young/old, new/older users, HIV/AIDS-affected/not affected, and farming/non-farming livelihoods. Market survey confirmed the actual prices of goods and services in local towns (8). Participant and direct observation (9) during fieldwork provided many insights into signal coverage and charging issues and included tests of “phone use diaries” (10), hand-held solar chargers, and new handsets. A small formal phone-based survey in July 2008 followed-up on handsets and lines (i.e., the SIM cards/phone numbers listed during the survey). Other data cited here come from other sources collected during the course of field and document review (11).

Study Site

The study site spans about 15 square kilometers of rocky terrain (see Figure 1). It sprawls 5 km along the only paved road leading to the district capital, Bungoma and 3 km away from the highway into the interior of the village. Motorized vehicles are rarely seen in the village. The village lacks Kenya Telkom landline or a “simu ya jamii” (fixed wireless public phone). The nearest *simu ya jamii* is a ½ - 1 hour walk away (and/or 20 Ksh bus fare) to a market town with electricity. The nearest landline is in Bungoma town (1 hour, \$.50 bus). The study area contains three (overflowing) primary schools, numerous churches, and three minor market centers (with small shops, grain mills, and beer-halls –but no airtime for sale). Water comes from a borehole, wells, seasonal springs and streams. The nearest health center is an hour’s walk away in another administrative division.

Just over 5100 people live in nearly 900 households in the study catchment area. The area was settled by a few Bukusu-speaking clans in the 18th century and is still home to their descendents (in several sub-villages). The size, density and land fragmentation reflects population growth particularly since the 1950s. Large families are common, and polygyny persists (35 men in the survey aged 30 to 60+ have more than one wife). Meanwhile, in-migration brings new residents and young couples seek land. Farms now average under 3 acres, with families averaging 6 people. Education levels are generally low, but some residents are college-educated professionals. Housing is mostly mud and thatch, radios are owned by only half, and hand-hoes and ox-ploughs used for land preparation and weeding—but a few cars are to be found. Cash crops include maize, tobacco, sunflower, horticulture (and previously cotton and sugarcane). Maize is the staple food and cash crop. These, plus food crops, small handicrafts, wage work, small businesses, remittances, and work exchanges are the major livelihood activities that are combined to provide goods and income throughout the year. A low-skilled worker earns a wage of about \$1.50-2.00/day (Ksh 150-200/day).

The area is thus a fairly typical poor, undeveloped rural community in western Kenya, remote from the capital city of Nairobi (8-12 hours by bus). Most residents rely on rain-fed farming and other activities to patch together a precarious living.

III. Findings from the Western Kenya Study Site

Before the survey, in 2005, key informants suggested that only six handsets were owned in the village—penetration was very low. The only service provider was KenCell (CelTel/Zain) and signal did not reach the interior of the village. By February 2007, cellphone signal for both major providers (Safaricom and CelTel/Zain) reached into the interior of the village, and 15% of all households owned a phone. These 125 households reflect rapid adoption of the new technology since 2005. Representing only 7% of the population, this level of handset ownership remains low relative to the nation: Kenya has an estimated 12 million active SIM cards in circulation now for a population of 37

million, yielding a penetration rate over 30%, but most of these subscribers are in the major cities. .

Who owns phones?

While households do share phones, an individual is recognized as the owner. The earliest owners were mostly male heads of household (78% of phone-owning households in the village). The earliest adopter is described in Text Box 1: a non-native professional family man.

--Text box 1 about here

The spouse is the primary owner in 18% and grown offspring in 7%. Phones are diffusing from older male, income-earners to their farm-bound spouses and younger generations within the family. Handset ownership is thus somewhat concentrated, with 41 of the 125 households owning from two to four handsets, belonging to different family members. Phone owners tend to be better educated: Over 50% of phone owners have completed secondary school or higher and many have professions such as: accountant, veterinarian, pharmacist, teacher, manager. In 28% of phone-owning households, the head regularly "works away", i.e., has a wage-earning job in another location, ranging (in this community) from nearby district towns to Nairobi, Mombasa, and Uganda. Phone owners also include many more newer residents: 45% of MPO households settled on the farm in the last 10 years, most seeking land of their own. Buying & selling crops and running a business are disproportionately represented among phone-owning households (Table 1): these activities both require communication, facilitate movement through market towns and provide ready access to cash. These owners are generally better off, too: they have more physical producer assets (i.e., land, farm tools) and consumer items (radios, lanterns, improved stoves).

--Table 1 about here

Handsets, providers, and functions

Nokia and Motorola are the leading handsets, accounting for 74% of handsets in 2007 (Table 2). By 2008, these two manufacturers are clearly taking over (Table 5). Owners spent a low of Ksh 1000 (for secondhand) to Ksh 35,000: recent prices are around Ksh 2-3000. Brand new phones are becoming more common, reflecting the arrival of several ultra-low cost handsets (ULCH) Motorola C113 and Nokia 1100 and 1200. All users are prepaid. Safaricom, the largest service provider in Kenya is capturing more of the market, but 20% of owners have both Safaricom and Celtel prepaid lines. Handsets support only a single SIM card (an expensive dual SIM Samsung is now on the market but at KSh 24,000 in Nairobi). Other SIM cards are kept in wallets or phone covers, and easily lost.

Who does not own phones?

Of the 720 households that do not own a mobile phone, 38% had “ever used a mobile phone”. Most borrowed a handset from a friend or relative to place a voice call. Only 5% used relatively expensive public *simu ya jamii*. Among households that do not own a phone, most (>90%) report the cost of handsets, airtime and charging as the major barrier, rather than complexity. These households are extremely cash-poor: operating costs would have to come down significantly to use, much less own their own. Households that do not own mobiles (see Table 1) in general have fewer assets and rely on low-paid casual work or selling charcoal, pottery, and sisal rope. Infrequently, women who don't have a phone mentioned their lack of spending money and concern over husband's reaction if she were to procure one first. A few older respondents had not even seen a mobile phone before the interview team reached them.

Using, but not owning: Sharing vs Public Phones

The entrepreneurial “village phone” model is not common in Kenya yet, mobile ownership low, landlines far, and *simu ya jamii* expensive. Remarks one informant:

“I will borrow a friend's phone! at one time, I went to Mayanja [the closest market town] and used a *simu ya jamii* and just saying hello and a few words I was told to pay Ksh 200. I have out the money and walked away very angry. I would rather borrow a friends' phone to use and pay him/her.” (W, male, 62, retired civil servant)

Family pressure, poverty, and cultural norms require sharing, although many owners dislike sharing. The phone is expected to be shared, as these quotes illustrate:

“This phone is like a communal one... You see, any person you meet...asks me, please help with your phone...my child is very sick ...So this phone helps so many people (*Lusimu luno luyetanga babantu bakali*)” (JN, 45, mother, HIV+ activist)

“If a neighbor comes to borrow you cannot deny him.” (C, 29, farmer, mother)

“I cannot say that this phone is mine alone” (E, 24, trader/farmer living in father's household)

Furthermore, sharing mobile phones in the village takes many forms: sharing the whole phone, part of the phone, with or without the owner, and without necessarily being compensated for airtime or battery use. Thus, complaints include the inconvenience of swapping of SIM cards (i.e., resetting defaults, damage to SIMs), running down batteries, using up airtime, loss of privacy, loss of control over the phone, are among the many frustrations owners face:

"If you give someone your phone he or she wants to call every time while the battery is discharging. Sometimes some people want to read your confidential messages which are not of any use to them. It disappoints me... I give it out but with conditions." (J, female, 44)

"You can find one friend that has no line, another one may have a line, but does not have a phone...So it will depend on how a person has approached you. He may want to call or to just flash. It will also depend on how much airtime I will be having in my phone." As for swapping SIM cards "Due to the respect that exists between us, I cannot deny him. It will force me to change SIM card although it is not advisable. " (E, 24, trader)

Different people have different claims on using the phone and how they use it, as one co-wife in a polygynous household relates (in Box 2) in relation to "swapping SIM".

--Text Box 2 here

Sometimes, sharing oneself goes with the phone, which adds to the inconvenience: "You see like even yesterday, my neighbor called me and told me to go to his home in the morning today so that he could call and talk to his wife through my phone. So I went there and by 8 AM I beeped him. He immediately called back and I gave his wife to talk to him." (W, 60+ native man).

A community support group member shares the phone with fellow group members even when they have their own phone, since so often they lack airtime or charge:

"There are those in the group...some have phones and when they don't have airtime or charge in their phones they approach me requesting me .. *Wase ese chisendi mbamo ta, se ufulashilakho enamba yino* (My friend, I don't have airtime, so would you please flash/beep this number for me?). So, he would tell me the number, make the call for him, and when it gets through, I give him the phone to talk, when he calls back."

Far from being of "no cost" because borrowers come with prepaid scratch cards (Samuel et al 2005), handset owners find sharing a phone has many costs, but is worth it. In the end, while owners complain, they realize that having a phone and being able to share it establishes social credit. One young woman (c, 20) who only recently was given a phone relates: " I just share out my phone with expectation that one time in future, I may also have a problem and that person will help me".

Voice over Text

As other studies of rural mobile phone users note: despite the range of computing, image viewing, music and data features they support—mobiles are principally just phones for the newest adopters. Voice calls are regularly made and received by over 90%. Alarm, calculator, games, and music composition were known by about half of phone owners, but not used regularly. Those features just use up the “jaza” (battery charge). Receiving airtime (i.e., via Sambaza) from another phone is more popular than “sending airtime” and the only way that some get access to airtime. Two respondents used GPRS/EDGE to access internet (the hardware existed in 2007 in the village). Seven reported using “news services”. Two recognized “Mpesa” (13).

Text messaging, while used by 75%, and despite being much cheaper, is not much liked. Voice calls provide immediate feedback to the caller using the phone for “urgent and pressing” needs: “You better call him and talk so that he can tell you live ...[with] a message you cannot tell if one has ignored it or not!” notes “R” (long-distance housewife, text box 3). A young commercial farmer “E” (24, male) elaborates “Sometimes I use text messages but I may want hand to hand information *Khwiru Khwiru* (“ear to ear”) Sometimes I may send you a message but you reply to me the following day...”

Fluid shifts between multiple languages are facilitated by voice vs. text, as one native resident explains:

“I use Kiswahili when talking to Bayabo (Saboats) and Kikuyus. I have some in-laws who are Saboats and Kikuyus. Some of my daughters are married to Saboats and one is married to a Kikuyu. So I talk to them in Kiswahili. I use Kibukusus when talking to Bukusu. You see like when you called me I just talked to you in Kibukusu.” (W, 60+ native of the village)

For W’s elderly parent, voice calls are essential to the value of the communication, and reflect the novelty of having access to any phone at all (i.e., whether landline or mobile):

[My own very old mother] at times requests me to talk to her grandsons... when she hears them talk on the other end, she breaks into a laughter...saying “*Aki J-- nomwen, lakini nakhalola, mulusimu sembona tawe*” (It’s really J-- himself but even when I look into the phone, I can’t see him!)

Many users express uncertainty about whether the text message ever arrived. The other parties do not text back—having not seen the message, lacking cash, or not knowing how to. As J- (a 44 year old woman) observes “I do not know how to scroll down to read the messages or send...!”

Another middle-aged woman commented: “...to write a message...[is] very difficult for me. You can write a message but ... “[indicates a space]” ... I want to write the name G--- and then the second name. The two names] are joined together... I have tried hard!” (G, female, aged 50)

SMS can be difficult, involving different menu items, buttons with multiple meaning, the selection of “dictionaries” (i.e., English, Swahili), and predictive vs. other text entry modes easily engaged by accident. All these skills can be hard to remember for these less-intensive phone-users with limited experience. SMS is difficult enough to use with English, much less for Bukusu, characterized by long words and imprecise spelling (there is no published dictionary of Bukusu). In contrast to perception (Samuel et al 2005), it is not illiteracy *per se* that is the primary barrier to using text messaging, although it clearly does inhibit some users. Basic reading and writing is found among most people under 50 (most of those who own phones). Instead, given the constraints on phone use, SMS does not meet the needs of these users.

Who do people call, and why?

Respondents were asked who (and where) they called recently for “personal”, “work/business” and “community” affairs, and what the call was about (in general). Personal calls to husbands, friends, and family are common. Distinctions between personal, private, family, business and community uses are not always clear, however (see Table 3). “Personal” calls also included farming, local business and financial transactions, for example. Some calls were just about “staying in touch”. These connections, as described in examples below, and confirming other research on the topic (i.e., Goodman, 2005; Horst and Miller, 2006)) help nurture social capital vital to the lives of men and women in this itinerant society dependent on community action and relatively “long-distance” relationships: even when the geographic distances are not actually that large.

Table 3: Content of recent personal calls

Business-related calls help organize the sale of goods, purchase stock, arrange work-related meetings, reach colleagues for people working as a livestock trader, accountant, or teacher. Much attention has been on economic uses of phones for reaching markets, selling products, and finding new contacts. This does happen, but as one farmer (R, 47, female, mother) admits “...I do not used the phone very much or oftenly to find the market. I will be lying to you. I rarely grow for sale, I mostly grow just for family consumption.”

When asked about how they use phones for farming and agriculture, none of the informants mentioned using text-messaging services to find standard prices. Instead they used their local, personal contacts to find specific prices in known places.

E, the young trader/farmer, calls “a brother to ask about market prices and prices for farm inputs!” Another (P, female, 23) points out “I have friends in Kitale. I ask them about market prices and they go to check for me market conditions.”

Furthermore, owners need to arrange for labor, tools, and seeds to be in the right place at the right time simply to produce a crop:

"During the ploughing season, and I want to grow or plough land, especially when he is far, I usually call and say ... that I have hired somebody's oxen and I want you to bring me some money to pay them. Sometimes when I need seed and fertilizer I always call him and inform him about it." (R, female, 47)

"[My mother] may want to get fertilizer from Chwele when she is at home or sometimes she deals mostly with selling of groundnuts...[she] may call her friend to bring for her ...She will save more time to work on the farm rather than traveling..." (S, female, 20)

"... now that I am working in Uganda, I can manage and market my agricultural products without necessarily coming home. But before, I bought it I had always to look for transport and travel home to coordinate these activities." (B, male, 27)

Destinations of most personal calls are people located within the village itself or nearby small towns (26%), as well as within the large District, mostly to Bungoma town (29%). These local calls replace a walk, local bus, or bicycle taxi ride. Distance is relative: one remarked of having relatives "who are far like in Chwele", a town about 10 miles and 20 minutes away by matatu (plus a 10-30 minute walk from the interior of the village).

Rift Valley and Central Region urban centers such as Nairobi, Kitale, Eldoret, and Nakuru account for another 42% of personal calls: given the distances, these calls clearly replace hours of travel each way on inter-city buses, and less frequently, Posta or landline. In comparison, only 29% of "business" and 13% of "community" calls were placed outside the district.

Sometimes the mobile phones also travel to these destinations, but not always. One 62 year old community group member and farmer, "P" leaves his handset at home with the family so that he can call them: "I travel a lot and at times, because of the uncertainties, I use the mobile phone to update my family members about the progress of my journey."

Evidently, long-distance personal and household affairs as well as more localized community and work affairs are facilitated by voice calls over mobile phones. Text box 3 reveals this geographical phenomena through the case of one long-distance wife, mother and farmer; HIV+ herself and involved with other HIV/AIDS affected individuals and their families. Especially for women in Bukusu culture, marriage is the only way to gain access to land, and with men often work away for wages (since the 1920s, throughout Kenya), phones are vital to long-distance family relationships.

--Text box 3 here (R, Long-Distance Farmer/Housewife)

Uses for self-help and community groups

Phones have evidently increased the efficiency of groups, and reduced the inconvenience involved in organizing communal activities which are

occurring faster and faster these days: "Let's say a sudden meeting is called...and you wanted to meet today ...There will be not enough time for you to travel there.... You can call one even if using her neighbor's contact number to tell her about it and she will definitely come." (G, female, 42)

Residents belong to dozens of voluntary, self-help groups and manage projects such as care for AIDS-afflicted, support for an orphan, managing grain mills for group income-generation. Churches and spiritual affiliations are important sources of solace and social support through personal calls and occasionally generic gospel text messages. Informants during in-depth interviews were asked for examples of how they use their own mobile phones to organize voluntary community work for the destitute, to AIDS affected, and to vulnerable children.

"some support groups were lending out some loans...if I have a member's contact number and we have some problems, I can call her..." and "If the food [support] ... has not reached some people. I can call the group responsible and tell them..." (C, female, 29, member of community-based HIV/AIDS support group)

"[the group has] a kitchen garden... money is required to buy seeds, or chemical for spraying or fertilizer of the group ..." (J, female, 44, HIV+ activist)

"...to track [those who are] HIV+ to remind them to go/access treatment" (P, male, 62, community health worker)

Phones thus help community-group members share information, manage gardens, distribute food aid, and help with treatment regimes. Some of their beneficiaries actually have phones. Often, however, these volunteers speak to each other by phone to organize services on behalf of the less fortunate who tend to be poor and do not have a blanket, much less a phone.

What good is a phone?

Phones are practical tools that offer convenience and cost-savings, providing context-rich, useful information that avoids wasting time and money. The top benefits mentioned were: "convenience" (mentioned by 80%), "replace transport" (71%), for "emergency" (65%), "save time" (52%), and for "organizing one's life" (46%). About 43% like "staying in touch" and 34% appreciate the mobile phone vs. postal services. Mail can take weeks to reach people who in many cases do not have a post-office box (Kenya lacks residential mail delivery, using only post offices).

Mobiles seem to have replaced writing letters completely: "Is there any use of writing a letter? I think people of *Posta* have no market!" notes "G", female, 42.

"W", 62, a retired civil servant confessed "I have even forgotten how to write a letter. Writing letters, putting in an envelop and putting stamps... I

don't even know whether such things still exist or they have been phased out."

When asked about how things "used to be before the mobile phone": "J" (35, mother, farmer) recalls: "If my child was sick, for me to know about it I had to travel to Bungoma to use telegram or to make a call."

Phones also bring a sense of freedom from uncertainty, plus peace of mind, and a sense of being connected to others: "With a phone, I can't starve to communicate/talk with people. If I want to talk with a person, I can 'flash' that person if I have airtime, I can call and talk to that person." ("R", 44, mother, group member, and long-distance wife)

For a few, especially younger owners, they are fun and modern: "After my work, I play games instead of sleeping or start writing out drafts [i.e., messages]. It will keep me busy" reports S (female, 20). This young woman, a high school graduate says "I see myself as being different ..."

While practical, mobile phones were remarked upon by many in-depth informants in reverential terms as "amazing" and "a blessing", bringing "light" to dark huts and villages. "God is of wonders. See now I can communicate while carrying it in my pocket" says the young trader, "E".

What do phones cost?

These benefits come at a high cost for people whose livelihoods and food security are based on small-farms of 1-3 acres watered by seasonal rains, complemented by casual, often seasonal wage work, and communal exchanges. Cash is essential for paying school fees, manufactured goods, and other items. Thus, paying for a handset and airtime competes with other valuable cash expenditures. Handset prices have dropped, but in 2007 were still relatively expensive at Ksh 2000-3000 (and they have come down further since then: see Table 4). Reported spending on airtime was as little as Ksh. 50.00/month (less than US\$1.00) for a phone user who mostly receives calls (which is free) and/or is sent airtime from another phone. This user will "flash" or "beep" others or use the free "please call me function." It is perceived as rude by some, but still is used. Low denomination cards introduced in 2007 are popular: 62% rely on only Ksh 40 or Ksh 50 scratch cards which allowed one 3-5 minute call. (A Ksh 20 card is now the market.) As much as Ksh. 6,500.00 (about US\$100) was spent each month by one heavy user, a trader/businessman.

Relatively small amounts reflect large expenditures in relation to other costs households face and the difficulty in procuring cash needed for school fees, medicines and other essentials (see Table 4). A Ksh 50 card used up in a single call can buy maize to feed a family for days. Running out of airtime and the fact that phones are "consuming too much" were frequent complaints.

--Table 4 here

Another expense in time and money is battery charging ("jaza"). Mayanja, the nearest town on mains electricity, supports dozens of small kiosks (see endnote 8). "Charging" can involve walking 1/2 hour to the road (uphill), public transport (Ksh 20), leaving the handset at the kiosk for several hours,

paying around Ksh 20 per charge (Ksh 30 when a generator is used). Phone use diaries (endnotes 9,10) indicate that a single weekly charging expedition consumes half a day and Ksh 60: while combined with visits to shops, this is inconvenient.

Furthermore, misuse, abuse, and generic universal chargers ruin batteries. Theft is a worry: "Now, I take it for charging...[and] wait for 2 hours... [the] battery was stolen while charging. They exchanged [my] new battery with an old one!" notes one female respondent.

These small kiosks, furthermore, make little money for the owners. Shops combine selling airtime in very low denominations with very little profit margin with other bicycle repair, grocery, phone repair, accessories and other sales (endnote 8). Since the customers are cash-poor, revenues are low. It is a hard way to make a living and turnover is common. (Personal communication in July 2008 with Geoffrey M-, formerly running the only cellphone repair shop in Mayanja).

A minority of owners (18%) charge phones regularly "at home" (i.e., on an installed solar system or a generator) or at places of work, including schools, churches, health clinics, retail boutiques, supermarkets. These better-off owners thus do not patronize the nearby kiosks, further reducing the local economic benefits of mobile phone industry.

Battery, Battery, Battery

When asked about a time when a mobile phone "didn't do what you hoped it would to do" most in-depth interview respondents gave a story involving their battery. Phones die after a few days, are turned off much of the time, and have a short life. Correspondents miss important calls and messages, notes P (23, a mother):

"...my child fell sick/ill and my husband was not around also... the phone had fallen down and [had] its screen damaged.... the battery was out of charge and the phone didn't have airtime... I just got disgusted with my phone..."

Users prefer voice, but calling uses more battery. They would like to try games but avoid using those accessories: "I don't want them. They are not important to me, If anything they would just waste my battery charge." (W, 62). They need flashlights—but they use more battery. Even new long-life handsets (i.e. the MotoF3) fell short, as the model we tried did not keep its charge for the promised week.

Attempts to reach known owners in 2007 to arrange follow-up interviews often met with recorded messages: "the subscriber cannot be reached." A rigorous phone follow-up survey in 2008 revealed 54% of original lines out of reach, probably in part due to phones switched off and lines inactive for lack of battery (see Table 5). Not suprisingly, respondents requested "solar" and "electricity" in the village.

In response to difficulties with "jaza", phone owners adapt: they:

- leave it at home (when lacking charge and airtime, and worried about loss or damage);
- turn it off (to save remaining charge (but missing messages and calls));
- swap SIM cards when their battery dies into another handset (but this causes inconvenience in having to restart the borrowed phone);
- swap their batteries with the charged battery of another user (again, causing inconvenience in having to restart, and many batteries are incompatible);
- avoid using extra functions such as calculator, games, alarm, music.

Plentiful sun, fragile devices

Solar charging is often touted as the answer to lack of electricity in rural areas. Sun is plentiful, and the products are becoming more readily available. Pilot tests of a small hand-held solar charger (see Text box 4, Figures 3a, 3b) suggests that while they are desirable, and help save on charging trips, there are problems.

--Text box 4 here. solar charger test

--Figure 3a,b

The small, portable solar chargers on the market (in Nairobi) have problems: they are expensive, the primary barrier to owning. They are prone to theft, limiting their practical use. The instructions are opaque, inhibiting proper use. The rechargeable batteries that are desirable (so the charger can sit outside during the day and charge the phone at night) wear out and are difficult to find. The multiple adaptors provided with small chargers do not work with many local handsets, inhibiting sharing the charger. The whole device, especially the internal wiring, is fragile and easily broken, especially when used every day as a primary charging source. Portable chargers need to get more durable, cheaper, and have universal adaptors if they are to meet the needs of these rural users.

Larger, permanently installed solar systems are used in several households for lighting, charging. Such a system is comprised of (for example) a 35-60 watt panel, 12 volt battery and 250 watt inverter. It can be more robust than handheld chargers and serve other purposes; but they cost much more (Ksh 40,000 vs Ksh 5000). Locally manufactured batteries are easily drained and inverters break.

Lost lines

Prepaid SIM cards get blocked, locked, diverted, and become inactive. Blocking and unblocking of phones because of entering the wrong PIN number is common, and apparently a big business in Bungoma town, according to signage advertising "assistance with unblocking".

One new owner interviewed during the survey confessed:

"I had not known well how to operate it. And I really wanted to use it. But when I switched it on ...the SIM card got blocked... I approached my friend who asked for Ksh 50.0 (about \$0.75) to unblock it... but by that time it was too late for my message." (PL)

Inactive lines result when users cannot use their lines, often due to lack of cash, access to airtime, broken handset, and dead batteries. A follow up survey by phone over 4 days in July 2008 called 84 original phone numbers that were listed with the survey respondents: We spoke to a known person from our original survey in only 35 households (44%). This is a low level of continuity in lines/numbers over eighteen months. The remainder were out of service (21%), diverted (18%), or out of network or switched off (18%).

--Table 5 here.

In comparison to problems with keeping batteries charged and SIM cards alive, the cellphone network has improved dramatically. Both Safaricom and Celtel have extended and maintained service to most of the populated areas of Kenya, while in the study site, new masts and towers were erected literally almost overnight and now dot the landscape. Signal coverage was rarely an issue for field work and was not a frequent complaint among respondents, although it used to be a problem.

IV. Discussion: Effective Use in Underserved Populations

Who are these phone users in rural Africa, where the devices are taking off more rapidly than anywhere else? How do these poor rural residents actually use their mobiles? What problems do they face? What can their experiences tell us about how to improve mobile phone system design to make them more effective for the most disadvantaged populations around the world?

Owners and users in rural Kenya

In the study community of nearly 900 households and over 5000 people, about 200 handsets were owned by 125 households. About 15% of households (7% of the population) in a 15 square kilometer catchment area are official "subscribers". This level of penetration is much lower than in other parts of the developing world (i.e., India, China which have nearly a billion subscribers between them: ITU 2008; or Jamaica with nearly universal uptake: Horst and Miller, 2006).

Handsets are not only more prominent in some developing countries, they are more prominent in some households. In this part of rural Kenya, handsets and lines are shared out, which means the still rare handset could reach probably hundreds of households and would serve extended and multi-residential families spanning the country. This sharing is selective, as ownership is biased: the mobile phone is found where households have adopted the radio, improved stove and new seeds. Men have more access, and women

remain dependent on receiving airtime, awaiting the remittance or the harvest for some cash to buy airtime. Users are not just the primary owners, but other family members with varying claims on the phone. Other mobile phone users are not owners, but partial users—they buy a scratch card and go find a willing friend or a less desirable, expensive commercial phone kiosk. Such sharing is problematic: lack of knowledge and cash to procure, use and share the handsets, scratch cards, SIM cards, battery charge hamper effective use of handsets in the village.

Mobile phones do, however, clearly facilitate the much desired “ear to ear” (verbal, direct) communications that enhance personalized communications between known and trusted kin, and with social, church/religious, and economic support networks. These networks help grow food, generate income, avert and manage crises, and stay and feel connected to valued groups. The fact of using phones to “greet” in a poor community with limited access to cash is not surprising in itself (Goodman, 2005), but its popularity reflects a high level of interdependence, the explicit valuation of these social networks, and the blurring of multi-location private, family, work, and community networks sustaining rural lives.

Specifically, phones help organize traditional labor-intensive tasks of agriculture, which are the same for the small-holder farmer or the professional (“weekend”) farmer. Planting, weeding, harvesting, and some degree of sales are vital to food insecure and cash-hungry. Getting market price information, a popular image of how mobile phones are used by rural residents, does empower a grower during negotiations; but first she has to have a crop. Phones help these families whose members span relatively large distances manage tasks (i.e., getting the land ploughed to time with the coming rains) are highly time-dependent.

Phones also complement small-scale voluntary activities to promote health, improve nutrition, and generate income. Among the HIV/AIDS affected, relevant mobile phone applications are not in fact SMS reminders to ART patients (Harrison, 2005; Shackleton, 2007). Instead phones are used for personalized conversations with trusted friends and volunteer, lay health workers. Furthermore, far from generating income as a group-run “public phone”, using phones for voluntary activities consume scarce cash. The relatively better-off subsidize their even poorer group members, kin, and neighbors.

They might not make money, but they can save small but significant amounts of cash and time. Phone calls help overcome feelings of isolation among those lacking mail delivery, newspapers (at Ksh 35, the *Daily Nation* or its competitors are rarely seen in the village), and working radio (only 50% ownership in the village). Mobile phones do facilitate economic transactions, such as trading in cattle and maize, and might actually increase profits for some business people. It is not clear yet if the availability of phones have lifted any households out of income poverty --that assessment would require careful longitudinal, follow-up research to attribute indirect impacts on the poorest.

Where the technology was unknown a few years ago, the device now seems essential to many, but not because it clearly makes money, finds new

markets, or receives informational messages. Avoiding an hour's under a hot sun on a busy day with children to supervise and food to prepare makes working with your community group more efficient and less frustrating. Knowing that your supplies are not there yet saves the bus fare to town. Investing in your children's education is more rewarding when you can talk to him at distant boarding school—plus, this is also your retirement. Furthermore, handsets and ringtones are increasingly visible and audible in rural areas as they are already in urban areas; they are signifiers of being modern and privileged, and that is of value to many owners, apart from economic and practical benefits. Far from being bothered by calls during a meeting, interrupting the flow of events; a ringtone is a sign of being important. Someone you know and respect is spending hard-earned money to make that call to you, so it can be rude to reject.

Mobile phones as technologies for development

Reflecting on these owners, non-owning users, their adaptive uses, problems, and prospects for the future: it appears that the “mobile phone” is different from (in its speed of diffusion and relevance) but also has much in common with many technologies introduced over the years into rural Africa, from new maize varieties to anti-retroviral therapy (ART) for those living with AIDS. Mobile phones are different because the technology presents a remarkable technological success story, especially in comparison to many ICT development projects, such as rural telecenters. Low-cost handsets with dust covers, flashlights, longer life batteries have helped extend ownership. Building masts, sharing hardware, and other industry investments have extended signals throughout non-urban Kenya, essential to local communications. Cellular technologies have succeeded so far due to the fruitful intersection of intelligent private sector design for the poorer markets, as well as strategic public sector planning around public goods (i.e., competitive environment for mobile companies, assigning frequencies by the Communications Commission of Kenya).

However, this success is also in part because of the lack of reasonable alternatives for basic communication for the rural and remote. Cellular phone calls seem cheap if the alternative is even more expensive in financial and emotional terms. The phone is less aggravating than the other alternatives available to rural residents: i.e., travel by foot, bicycle taxi, local bus, inter-city bus, telegram, public landline, or regular mail.

Like many other innovations, the technologies involved are “foreign-designed” (whether from central Kenya or Finland), dependent on a larger system, and beyond community control. Like ART and commercial agriculture, mobiles are part of a larger globalized system—reliant on a long supply chain of electricity, airtime, medications and fuel. Like many other technologies, rural consumers face lack of choice, whether in the choice of medicines, seeds, battery capacity, or language menus. The rural users as we see in this case study learn to make do: these phone users have experience accommodating to unreliable products such as cheap metal hoes, and inadequate formal services,

such as poor agricultural extension. SIM cards and handsets fail, as do water pumps, maize varieties, and bridges.

The effective use of phones by the poorest remains a challenge because of social and electrical power constraints. As with many other technologies, while phones have nominally reached “everywhere”, not everyone has equitable access. The underserved people reside where handsets exist and signals already strong, but especially in areas where masts are just appearing. (Some firms and developing agencies are attempting to overcome barriers to access in the most remote locations: endnote 15). Some barriers to wider uptake can be addressed through changing tariffs, subsidies for poor communities, special energy projects, and educational programs to improve the knowledge base: these will improve the effective use among the poorest and help address the real “access gap” (Kelly, 2007).

In terms of technology: the handsets, however, might well be good enough. They can certainly be cheaper and better and longer-life, but the low-cost, durable products from Nokia and Motorola work well. Stabilizing handset design, rather than introducing further refinements, could lead to further economies of scale (prices and buying patterns in the study site indicate this is happening: Table 4 and 5). As well, fewer, stable designs could help consolidate the bewildering and inefficient array of adaptors, chargers, and batteries and make handsets more effective for village locations where sharing, repairs and calls are made “jua kali” (under the hot sun, in the informal economy).

More functional public infrastructure is also needed. The most aggravating problems are not with handsets (although broken screens, confusing menus, and language interfaces were mentioned) but in the systemic problem of “jaza”: the lack of affordable local electricity and inadequate capacity of batteries, especially the used, fake, or badly handled batteries. Addressing this electrical power issue would probably be more helpful for most owners than would be the most user-friendly, readable-in-sunlight, vernacular-language handset that an owner cannot keep charged. Since large-scale formal rural electrification is unlikely to extend into the interior of this village, much less to even more remote locations off the grid: a range of alternative power sources using solar, wind, diesel, bio-diesel, micro-hydroelectric, biomass, human- or animal-draft, or even fuel cells) will be needed.

V. Conclusions

It was “about the [time of the] sunflower planting season ...” says one informant, fixing the time she bought her mobile phone. In her mind, two events of importance converge: an agricultural harvest providing cash, and the arrival of this new device. Handsets stand out to external observers against the backdrop of mud huts, maize fields, and dirt roads; they stand out to the owners and users, too. For phone owners, phones have gone from expensive novelty to (expensive) essential tool. For others, they are a valued but expensive source of help in an emergency. Images of rural mobile phone users

as traders and marketers are relevant—sales of farm produce are crucial to livelihoods of the poorest—but do not capture the real variety of rural users and uses. Phones remain in the control of group leaders, professionals, and more affluent. While still not yet very widespread among the poorest: uptake surged since 2006 and is likely to rise in the future.

Mobile phones are useful for two-way active communication, and not as much for passive information receipt. Exchanging context-specific personal information allow farmers, mothers, health workers, community organizers, small businessmen, and educators to do what they were already doing—talking to known friends, associates, and loved ones. They avoid frustration and uncertainty, and pay for the convenience. Popular images overemphasize the resourcefulness of small-scale entrepreneurs, the economic potential, and ignore the real inconveniences and motivations of rural owners. Sometimes, the “mobiles” are not mobile; they can only move around if the owners do.

Options for alternative energy are manifested so far only in costly, fragile solar gadgets. Handsets in particular “consume” through endless recharging, repairs, and airtime. Small farms, depleted soils, poor roads, inadequate tools, endemic malaria, bad water, low levels of education, and corruption hamper productivity. Mobile phones alone cannot overcome all these problems and might not alleviate poverty, although they can improve lives in ways that matter to rural residents.

Practical actions are needed: customer support, instruction about how to use phones and SIM cards effectively plus low-cost, convenient electricity will help owners, borrowers, renters and occasional users. Listening to these diverse owners and different kinds of users suggests that different decisions and tradeoffs matter to them: i.e., larger, less “mobile” handsets with bigger batteries and buttons would be welcome.

Findings from this case study are specific to western Kenya, a region less developed and commercialized than more affluent central Kenya. Each country’s mobile phone industry and infrastructure has its own character and trajectory, too. In this case, for example, taxes keep cellphone calls relatively higher in East African than in many other countries (GSMA, 2007). Even so, both the study approach and specific findings can still inform other research and practice, as this study in turn echoes and builds on findings from other surveys and observational research in the developing world.

Methodologically, the geographic case study complements other research approaches. Mixed methods can complement targeted academic ethnographic or survey research and blend the broad panorama (i.e., actual rates of ownership in the general population) with the personalized, grounded and rich insights that come through the experiences of real owners and other types of users as they go about their everyday lives. Sampling strategies—how we seek out informants—can lead us beyond the accessible urban owners to non-owning, partial users. More social science research is needed into mobile phone use in truly underserved regions of the developing world.

In terms of the larger implications of this study for ICT4D practice, mobile phones are a welcome and mostly workable part of a larger technological system which does not work well for the poorest. The visible

take-off of mobiles is in part related to other failures (i.e., roads, income-generation schemes). “Power” considerations—unequal social, economic, and electrical power—shape how, where, and who can effectively use mobile phones. Some of these inequalities and technical concerns can be tackled through technical, design and policy efforts that try to reach the poorest and least connected. Meanwhile, in this rural and increasingly tele-connected village, local residents are making do the best they can with this remarkable communication device. They certainly appreciate the opportunity to call.

Endnotes

1. The Study Site. The Bungoma field site was first selected in 2005 during another study of technology change in rural, AIDS-affected Africa. Then, a local NGO (ACE-Africa, working in the area) led us to Bungoma District, a somewhat neglected region fairly hard-hit by HIV/AIDS but where communities were actively responding. Local innovations in kitchen gardens and agriculture in response to HIV/AIDS and the orphan care burden were reflected in the study village. Fieldwork in 2005 mapped the village, identified HIV/AIDS affected households, documented kitchen garden innovations and infrastructure (see Murphy, 2008). The study site was then chosen for fieldwork on the mobile phone in rural Africa because we observed phones entering the village, and the area seemed fairly typical of the mixed-farm sector of western Kenya, while the PI had already begun mapping the village and had contacts there. Working in western Kenya raises issues of representativeness, however: mobile phone usage is probably lower than wealthier commercial farming districts, and the district less slightly integrated into the Kenyan economy and international export trade than Central Kenya. The study aims to reveal technology change in a relatively poor, traditional community, however, in which the mobile phone is one new technology. The study comprises perhaps the first academic, social-science case study into phone use for a rural community in Sub-Saharan Africa. In contrast, targeted surveys of entrepreneurs or traders, proprietary consumer market studies, national statistics on subscriptions, and journalistic accounts have provided the bulk of our impressions on how phones are entering rural lives.

2. Human Subjects Review. The social research involving human subjects was approved by the Tulane University Institutional Review Board (IRB) and received research authorization from the Kenyan Ministry of Education, Science and Technology (MOEST) in 2006. All adult (>18) participants were invited to take part using approved oral consent forms and procedures. All interviews and activities were conducted in Bukusu or Swahili, with translations provided by local research assistants and recorded by hand (the household survey) and/or taped and transcribed (for in-depth interviews).

3. Pretests were conducted prior to rolling out the full survey. These, plus prior discussions with key informants revealed that mobile phones in rural households in western Kenya-- while widely shared with other family members, neighbors and friends, are generally controlled by a primary owner. The phone does not belong to the family/household, but a specific person, but he/she belongs to a specific household, which was the point of entry for the study. Individuals also can belong to other households and families, as in the case of men with many wives, or young men who live away part of the time for schooling.

4. The Census. All households in the study site catchment area (a large village about 15 sq km.) were listed and visited. Through interviews with an adult, we gathered basic information on households, phone ownership, HIV/AIDS, livelihoods (income-earning activities), land, and assets for all households residing in the geographic area. Rural incomes are difficult to capture accurately since much production is for home consumption only and other valuable exchanges are also non-monetized; this study did not attempt to gather details on household expenditures/consumption, since that would have been a time-consuming data collection effort and would have compromised other study aims. The household survey instrument was pre-tested in January 2007 in Bungoma towns and rural areas (outside the study site) before being translated (Bukusu) and administered in the study site. The simple household level questionnaire was administered from February 3 through March 10, 2007. A team of trained, Bukusu-speaking enumerators identified and interviewed a responsible adult (>18) male or female head for every family grouping that “eats from the same pot” within the catchment area. These numbered 878, of which 29 did not respond due to the family being away, the adult respondent being incapacitated, or rarely, simply refusing to participate. A household roster gathered standard data on age, sex, education. Other questions enquired about livelihood activities, land, crops, tools, housing, and assets.

5. A structured, formal “individual-level” questionnaire was administered to one adult phone owner for each of the households in the census (125). For phone-owning households, this documented handset(s), acquisition, SIM cards, calls made (to whom and where), phone charging, airtime, benefits, and problems. Adult respondents in non-phone owning households were asked about reasons for not owning, ever use of a mobile phone, and perceived benefits and problems. The primary individual owner was sought out for this interview: This sometimes required several “call-backs,” or return visits (or phone interviews), taking up to several days to locate the person. The individual phone owner was often a man living and/or working away from the village for part of the time. No incentives were used during the census. No incentives were provided as this interview was conducted as part of the census.

6. Group interviews: Two group discussions were held, one with about 20 men and separately with about 30 women residents. Each was held in a local primary school on a Sunday, facilitated by a team in Bukusu and Swahili. The discussion yielded general insights and helped formulate in-depth interview guidelines. Group discussions are inevitably biased towards some individuals and generic answers, rather than specific and personal experiences (i.e., misperceptions around mobile phone industry emerged: the more vocal, educated, professional men in one group criticized the cellphone companies for being unfair for dropping prices of SIM cards and tariffs over the years, and expressed concerns about cheating and lying which did not arise as much in the one-on-one survey or individual interview.) Incentives were provided to the participants in group discussion, who received Ksh 200 airtime for taking up to three hours to come to an external venue for interview. They also entered

their name in a lottery to win a mobile phone handset, which was awarded in May 2007. The winner could choose between one of two ULCH, a brand-new (“In the box”) Moto F3 or the Nokia 1200: he chose the Nokia.

7. Individual “in-depth-interviews” (IDIs). The census effort documented all phone owners in all households residing within the catchment area through the household roster. Adult owners (>18) were then listed and categorized in terms of age, occupation, education, livelihood, duration of ownership (i.e., long-term, experienced, vs brand new). Individuals were recruited to reflect different types of users and uses, and invited for a longer personal interview. A semi-structured, open (vs. closed-response) guideline was used to solicit their personal experiences with the phone, how they use it, and its significance in their lives. These generated hours of transcripts (Murphy 2007b). In the end, more women (16) than men (4) participated in the IDIs, owing to the fact that many men phone-owners reside far away. These participants received a Ksh 200 scratch card of their choice for participating.

8. Market Survey. A parallel survey of shops and services in local market towns of Mayanja and Chwele, and representative high-end services in the district capital of Bungoma was conducted over 3 days in March 2007. The effort documented names and types of kiosks and shops, and their charges for airtime sales, phone charging, sales and repair services, and other goods and services.

9. Participant observation (PO) techniques include working with local residents using their own phones, observing them during group discussion, and direct field experience by the field team during data collection. This hands-on experience provided invaluable knowledge about issues mentioned by respondents in handset design, battery life, power and battery charging, topping up of airtime, using SIM cards, signal access, accessing Mpesa, as well as the rising visibility of phones, masts, and industry billboards over the time period. The PI has had a Safaricom line since 2003, and tried celtel for a while, but now only use Safaricom for simplicity. The field team used both Celtel and Safaricom, regularly swapping SIM cards and changing tariffs during the course of a week.

10. Daily use diary. The original aim was to document a “day in the life of a Nokia/Motorola” as it was used, shared, in and out of service or signal over the course of 24 hours. The motivation is that mobile phones’ built-in logs and SMS memory, while useful for understanding calls and messages; are inadequate to appreciating the history of the handset itself (shared, SIM-swapping, turned off). Also, calls and messages are not always saved, can be deleted, and require that the phone itself be available, have a charged battery, SIMs are swapped from one phone to another, etc. Thus we developed and tested daily and weekly rosters to record phone calls, texts, charging, purchases or receipts of airtime, and problems. Different forms were tried out with the survey team (i.e., more complex forms) and with several local informants (simpler forms).

In the end, the diary was not used on a large scale. It proved difficult to settle on a single standardized form that would work well for the range of users (such as “R” and “F” in text boxes). The pilot tests with one user over three weeks and with 3 other users over 2 weeks did provide useful insights however, which are integrated into the narrative. See Figure 4 for samples of real user diaries from “R”.

11. Other Data sources. The village case study covers topics beyond the mobile phone, spanning technology change in general, in the context of HIV/AIDS, population, land use and development. Interviews were thus conducted with (1) village elders around the history of the village, especially around environment, agriculture and HIV/AIDS, (2) home-based care workers around HIV/AIDS care and support services, (3) outside key informants on health and development projects in the area. Academic, government (official), popular (media) and internet (grey literature) complement the original fieldwork data. A village sketch map documented landmarks, community centers, water, roads, etc. Historical and official colonial documents in Rhodes House archives in Oxford were also pertinent to understanding the local context.

12. Signal/Network. In 2005, the only signal reaching the village was Kenyan-owned KenCell, later called CelTel, since 2003 owned by (and now branded) Zain. Safaricom was not represented in western Kenya and was associated with urban users. By 2007, new cellphone masts have sprouted up across the country, and both Safaricom and Celtel reach the village: Safaricom, the market leader, has extended service and captured much of the national market. Network coverage was good throughout the fieldwork, with few geographic gaps for either provider (based on direct observation during survey fieldwork).

13. “Other problems” with phones. Interestingly, 11% of respondents from non-phone-owning households worried about “cheating” or “lying” (i.e., school exams, extramarital affairs). These came up during group discussions and a few in-depth interviews. A few respondents provided colorful examples of (“someone else’s”) marital problems caused by “mis-use” of phones. For most, however, phones are perceived positively. Phone-owning individuals seemed to worried less about the prospects of cheating than their neighbors who don’t yet have phones.

14. *Mpesa* (*pesa* = money) the now world-famous money transfer service offered by Safaricom, had just been launched in January 2007 and was recognized by only two respondents. Since the survey fieldwork, it has become widely known in district and recognized by many in the village (according to informal observation and conversations). In the nearby district capital of Bungoma, Mpesa agents report a booming business. Mpesa is much cheaper than alternatives Western Union and Posta (run by the Kenya Postal service). All of them require the sender and recipient to travel by bus to visit specific

agents at specified offices in towns. This ties the services to major towns and cities. Also, sometimes the agent's float is insufficient for the transaction, wasting a trip. Mpesa can be withdrawn from any agent around the country, whereas Posta requires specifying a particular post office which restricts the recipient to a geographic location. Thus, Mpesa is generally more convenient and merits much of the enthusiasm around the novel money-transfer system.

15. For example, Ericsson and Nokia each have different pilot projects teaming up with other collaborators and aiming to improve electrical, cellphone and internet access to underserved populations in Africa (i.e., Malakata, 2008).

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Table 1. Characteristics of Households by Mobile Phone Ownership

Characteristics	Mobile Phone Owning (N=125)	Non-Mobile Phone owning (N=720)
Household Head's characteristics		
Median Age of head of household (years)	35 (17-72)	36 (14-87)
Education level of phone owner	52% beyond or completed secondary	n/a
Education level of head of household	35% beyond or completed secondary; 25% none or some primary	6% beyond or completed secondary; 59% none or some primary
% on land in <+ 10 yrs	45%	26%
Median land area owned in acres	3 (0.5 to 33)	1.75 (0-53.5)
Household head's activity = "regularly work away"	22	5.5
Household and Farm Assets (% owning)		
Thatch roof	18%	53%
>=3 rooms in house	68	30
Improved stove (jiko)	29	12.5
Working radio	58	38
Chimney lamp (storebought)	77	41.5
Bicycle	72	50
Motorized vehicle	6	0.4
Cattle (>=1 head)	78	52.5
Ox-plough	40	21
Wheelbarrow	38	6
Chemical sprayer	39	15
Watering can	40	24
Treadle-powered water pump	6	1
Major Household Livelihood Activities (% Reporting Activity as "Important" or "Very Important")		
Eat crops/produce from own farm	91%	89%
Sell crops from own farm	74	59
Casual daily work	18	31
Run a business (i.e., grain mill, shop)	38	28

Sell crops from other peoples' farms	26	21
(Make) Sell local pottery, charcoal	22	28
Remittances and donations from family	17	13
Exchange goods	42	35
Communal activities	52	42

Notes

1. Data based on interviews with an adult (>18) member of the household, usually the male head, his spouse or female head for 848 households in the catchment area (a 97% response rate). There were missing data for some indicators, and the working data set for MPO analysis was N=845. The household head was often but not always the phone owner.

2. Livelihood activities are not mutually exclusive. They were asked "What they do to get food and goods for the household?" and "How important is this?". Most households combine >4 activities, mixing own-farm and non-farm activities listed here, plus pensions, renting out land and "other".

Table 2. Handset Acquisition by Year, Make of Handset, and whether "Bought New" (N), "Bought Used" (U) or "Received as Gift or From Work" (G)

Handset and Service	1999 & 2000	2001	2002	2003	2004	2005	2006	2007 (Jan-March)	Total
Nokia	2 (N) 2 (U) 2 (G)	1(N)	3	2 (N) 1 (U)	7 (N) 1 (U)	12 (N) 6 (U,G)	23 (N) 1 (U) 4 (G)	5 (N) 1 (U) 1 (G)	75
Motorola	1 (N) 1 (U)		2	4 (N) 3 (U,G)	6 (N) 3 (G)	6 (N) 3 (G)	21 (N) 5 (U) 6 (G)	- 2 (U) 2 (G)	65
Samsung	-	2 (N)	-	-	1 (N)	2	-	-	5
Siemens	1* (N)		1	-	1 (U)	5	2 (N) 1(G)	1 (N) 1 (U) 1 (G)	14
Sagem	1 (N)		1	1 (N) 1 (G)	1 (U)	-	3 (N) 1 (U,G)	-	9
Ericson	-				1 (U)		-	-	1
Alcatel	-					1	2 (N)	-	3
Other	-					1	2 (N)	1 (N) 2 (U)	6
Total	7 (57% new)	3 (100% new)		11 (64% new)	21 (67% new)	36 (50% new)	70 (76% new)	17 (41% new)	178*
Service Provider by Year of Acquisition									
Safaricom	1	?	2	5	6	17	26	4	61+
Celtel	9	?	3	8	11	18	39	10	98+
Both S & C	--		2	2	3	4	10	4	25

Notes.

1. Handsets received as "Gift" or "from work" are also often (but not exclusively) new handsets.
2. The 1999 Siemens was the first handset acquired by any survey respondent
3. The 2005 new handsets included Nokia 3310, 1110, 1600; Motorola c115, c117
4. The 2006 new handsets included Motorola 113, 113a, 117, 118
5. Other handsets include Bird, Sendo and other unnamed handset manufacturers.
6. This information compiles data on N=178 handsets and 184 different lines acquired in these
7. 125 phone-owning households, which have from 1 to 4 phones each. (Data are missing on several (6) handsets, as the respondent was unable to provide the make/model/year)

Table 3. Summary of Content of "Personal" Calls

Category	Number of calls made	Percentage of all 'personal' calls
1. Greetings	120	58%
2. Family Affairs	24	12
3. Schooling	13	6
4. Meetings	5	2
5. Farm-related	10	5
6. Financial/Work	13	6
7. Health and Death	10	5
8. Where are you	4	19
9. Emergency	4	19
Total #	208	

Notes:

a. The content was extracted from the responses to questions: "Who did you call when you last used the phone (1) for 'personal' calls? What did you talk about? Where were they? (2) ...for 'work-related' and (3)...for community/group matter...? Up to three responses were allowed for 125 informants generating 208 items. Multiple responses were sometimes provided (i.e., "Greetings, ask about school fees": such calls were classified according to most detailed or specific content (i.e., schooling).

b. Explanation of categories:

1. "Greetings" also expressed as Know how they are faring, ask how they are doing, Missed her, friendly talk and related generic greetings.

2. "Family affairs" covers family and household concerns, i.e., discuss family affairs, family issues, what is required at home, deliver a message at home, assist with a problem at home, repair broken window, discuss family matter, help at home.

3. "Schooling" covers: education matter, encourage about his studies, exchange ideas during study, fees, progress of children, school accountability

4. "Meetings" includes meeting updates, meetings, discussions

5. "Farm-related": included comments on land and farming tasks, i.e, Ask for price of beans, ask money to buy land, ask him to come and organize planting, asking for money to buy maize seeds, farming issues, advice, get seeds, fertilizers, ask about rented land, remind them to bring onion seeds, request him to buy fertilizer, lend \$ to prepare /cultivate.

6. Financial/Work: Asking for help, assistance, work, jobs, to build a plot at Chwele, know price of goods, collect supplies, Ask for financial assistance, Asking for payment of debt, discuss rates for land sale/exchange, clients' animals' health.

7. Health and Death: To Ask him [husband] whether he had got treatment, Confirm where facial therapy is done, to inform them to visit her mum who was sick, tell him when the children are sick, funeral arrangements, ask for help when am sick, in hospital, Dad passed away, called brothers to inform, funerals, know of funeral arrangements.

8. "Where are you?" was the exact phrase.

9. "Any emergency" / in case of emergency.

Table 4. Cost of operating a mobile phone relative to other local costs

Item	Amount
Typical Local Costs	
Ploughing an acre of land: (ox-plough team, plough, and driver)	Ksh 1,200
One bag of commercial DAP fertilizer	Ksh 2,000
"Matatu" fare to Bungoma town (1/2-1 hour each way)	Ksh 40
Bus fare to Nairobi (roundtrip, one way is 8-12 hours)	Ksh 1,500
"Goro-goro" (2 kilogram) of maize	Ksh 15-20
Daily wage for casual farm laborer	Ksh 100-200
Thatching a roof (thatch grass plus skilled labor)	Ksh 750-1,000
New 3 pound commercial hand hoe	Ksh 250-350
Mobile phone costs	
Cheapest new handset, 2005	Ksh 6-7,000
Cheapest new Motorola or Nokia, 2/2007	Ksh 2,900
Cheapest Motorola or Nokia, 8/2008	Ksh 1,800
SIM card, 2007	Saf Ksh 100 Celtel Ksh 50
SIM card, 2004	Ksh 1,000
3 minute voice call, 2005	Ksh 75-100
3 minute voice call, 2/2007:	Ksh 36-75
Smallest prepaid scratch card, 2005	Ksh 250
Smallest prepaid card, 2007	Celtel Ksh 40

Notes.

1. Cost data collected during 2005, 2007 and 2008 fieldwork.
2. The Exchange rate was Ksh 61-66 to the US\$1 in early 2007 and Ksh 68=US\$ in Aug 2008.
3. In 2008, Celtel and Safaricom both offered a Ksh 20 scratchcard.

Table 5a. Summary of 2008 Mobile Phone Update

Summary Outcome	Number of phone numbers (households)
Original Owner reached in same (30) or other (5) location	35
New owner of line (i.e., not in the original survey)	4
Line no longer in service	14
Call Diverted	15
Out of network coverage	7
Switched off	8
"Call back later"	1
Total phone numbers (households)	84

Notes

1. A detailed status update for the 35 respondents we talked to in person is in Table 5b.
2. We will attempt again to reach those whose 15 'call diverted', 7 'out of network' and 7 'switched off' and one unknown respondent who asked us to 'call back later'.
3. We are trying to locate possible new lines/numbers for the 18 phone owners whose original lines were no longer in service, but have no details at the time of writing.

Table 5b. Update on Current Handset and Lines of Original Respondents (July 2008)

Handset, Service, Year, and Place Acquired (as of 3/2007)	Status of Handset, Line, Residence, Problems (update as of 7/2008):	Other comments by the respondent
Sony EricsonT10, Saf, 2005	Same household member; moved to N— town; same line, extra Motorola; left Nokia with family in the village. Old battery could “take long before it gets full.”	“Get <i>simu ya jamii</i> in the area!”
Nokia , Cel, 2005, Bung	Same handset used by the entire household; “phone quite consuming” because of fare to get it charged and buy credit.	“Help community get energy, e.g. solars for charging their phones”
Motorola C17, Saf, 2006 Bungoma	Same handset and line; never had problem with handset.	
Nokia, Cel, 2005, Nairobi	Same household; 2 handsets owned by husband and wife; Wife’s has problem “battery getting low all the time.”	
Nokia, Cel, 2002, Nairobi	Same household member; added new Nokia; phone has problem of battery getting low all the time.	
Nokia, Cel, 2004, Bung	“The one having it is the wife”; same handset though have added 2 more. Hard to recharge because “burdened with school fees.”	
Motorola, Cel 2004, Bung	Same handset; “fell in water so sometimes goes off”	
Nokia, Saf 2005, Nairi	Same line; changed handset because it “fell on the stone and broke in to pieces”	“help them get solar in the area”
Motorola C117 Saf 2004 Nairobi	“With the wife”, have old handset but have added extra handset in their household	
Motorola, C118, Cel, 2006, Bung	Same line, sold old handset and bought a Nokia; outer lining of the of the handset had chipped and the buttons had rubbed off.	
Motorola, C118, Cel and Saf, 2006, Bung	Sam old phone: loves his handset because it appears original	Complains of “cheating sms’ that “I won millions!”
Nokia 3310 Saf, 2003 Other	Had 2 lines, changed one because it got blocked. Charging phones is a problem to them.	It is expensive if need help from a Celtel person
Nokia, Cel, 2006,	“same line, changed the handset,	“help get energy i.e.

Other	wanted to get a new model. Problem: "battery getting low all the time", network	solar or generator"
Sagem, C920, Saf, 2003, Eld	Still same household member but moved to Eldoret. Handset "got spoiled": problem with battery. Bought a Motorola c168.	"..put up electricity!"
Siemens C135, Cel, 2007, Bung	Same handset; plans to get another handset with more advanced features	"...fake batteries in the market"
Nokia, C & S, 2004, Bung	Changed handset because "lost memory"; have 3 other handsets	
Motorola, Saf, 2004,	Owns the same phone; moved to G—town; have extra handsets.	
Nokia 3310, Cel, 2006, Bung	"wife had the phone"; he moved to S--; still have the "old handset of Nokia 3310 and love it" because easy to operate and gets information on time	
Motorola C117, C & S, 2002 Bung	"wife had the phone"; maintained the same handset because it has never given them any problem	
Motorola, C & S, 2006	Same handset, wants "extra phone for his mum"	
Nokia, Cell, 2006 Bung	Same old handset.	
Nokia Cel, 2004, K-village	Same line, changed the handset because its battery gets low all the time; button keys were not functioning well.	"open [phone] shops everywhere... so phones are serviced in a professional way..."
Nokia, 1110, Saf, 2005, Nai	Same handset; happy because "the battery takes long about 11 days." Will get an extra phone for wife	
Siemens C45, Saf, 2005, Kitale	Same household member; she got an extra handset because she loves bright colored phones	
Nokia S & C, 2005, Nai	Same old handset--happy with because it has "shortened the distance" which cost money, time	"Have some people sold their phones?... Why?"
Motorola C118, Cel, 2006, Bung	Same handset, plans give the old one to her mother, get Nokia because ...calculator, games, picture messages	"help get solar for charging"
Motorola, Saf, 2005, Nakuru	Same handset; problem of going off since "fell in milk at the charging place."	"Saf and Celtel: lower credit!"..."affordable phones"
Sagem, 920, Saf, 2002, Eldoret	Old handset; wants to get an extra Nokia with a flash light. He will give his dad the old handset.	.
Motorola C113A, Safaricom, 2006, Bung	Has the same handset; does not have any problem, wants to get an extra	"share with others... how important phones

	handset.	are"
Motorola, C68, C & S, 2003, Nai	One phone in good condition; "long distance" to get their phone charged.	
Nokia, 1600, Cel, 2006, Bung	Same handset; network not clear most of the time.	
Nokia, 1110, Cel, 2006, Bung	Old handset; due to network problem; wants extra Handset	
Nokia 1600, Safaricom, 2006, Eldoret	Has old handset, wants to give to her mum and buy a Nokia handset which has calculator, games etc	"manufacture affordable phones!"
Sagem, 920, Celtel, 2003	Same household member; moved to --; changed handset to Nokia because "volume was too low"	
Sagem, 920, Safaricom, 1999	Changed handset, retained line; wife wanted a bright colored phone; Nokia =easy to operate. Switches off most of the time to save the battery.	

Notes:

(1) The sample of N=84 households comprises all the respondents who provided at least one phone number during the original survey. For the other 43 households that reported owning a mobile phone in 2007, the respondent was unable to or reluctant to supply the actual phone number during the original survey. In some cases, especially the first interviews, the interviewer forgot to request and note it down. These 84 represent a range of owners according to household size, education and wealth status and thus can be considered representative of the full population of phone-owners in the village.

(2) Up to six attempts were made to reach one number/per household over four consecutive days spanning a weekend: i.e., Friday through Monday, in July 2008. Results of each attempt were documented. When a person answered, the caller explained the survey, identified whether the recipient was part of the original study and (if so) asked provide an update on the phone handset, line, any changes and/or additions, problems, and "any other comments". Respondents not part of the original survey were asked to share how they acquired the line; some provided details. Only 1/36 of the people actually spoken to declined to talk (was "busy").

3. Places of acquisition include Bungoma town (Bung), Nairobi (Nai), and other major towns and cities in the rift valley (Eldoret, Kitale), as well as from within the village (i.e., buying a used handset from a friend). In 2006, a surge of new buying occurred in Bungoma town as Nokia and Motorola's less expensive, yet truly brand-new handsets became available in the local supermarkets and phone shops: 70 handsets were acquired, 76% of them new. See Table 2.

Text boxes

Text Box 1. One Rural Early Adopters of Phones: The Professional/Part-Time Farmer

The first handset reported by residents was bought in 1999 by a university-trained company manager "F-". He lived part-time in the village where his wife (a school teacher) was raising the family and tending to a 5 acre farm they bought in the early 1990s (they are not natives to the village). They have owned 3 different handsets, and his wife just bought a new 'colorful' one (reported in 2008: Table 5). He spends about Ksh 2500 per month on airtime in Ksh 250 denomination—"spending on phones" is one problem, along with "short battery life". When in the village, he also has to charge in commercial kiosks, but also has access to electricity at his office. He has 180 contacts in his address book, calling Bungoma, Mumias and in the village. He was one of the 2 respondents already familiar with Mpesa in early 2007.

Data source: household survey and personal communication with "F"

Box 2 Phone Sharing: The Experience of a Co-Wife

Moderator How do you usually share the phone? Do you normally give it out wholly, or give out for people to put their own line before using?

Resp I usually give out the whole phone. No SIM-card swapping to my household!

M What about to your friends?

R They also just borrow my mobile phone as a whole

M Are there some who come with their own SIM cards?

R Yes! ... Like my other co-wife can borrow my phone to put her own line [i.e., her own SIM Card] in and use it.

M Do you ask those people who borrow your phone to pay you or do they give you airtime for using your phone?

R I usually tell them to buy a Ksh. 40 or Ksh.50 scratch card for them to call their friends.

M Do they pay you anything?

R No!

M Do you think sharing out your phone with other people has any problems?

R Yes!

M Which one?

R It can block...some do not know how to use it, you will find that they have blocked your SIM card.

Source: excerpt of in-depth interviews

Text Box 3: Full Time Farmer/Community Health Worker/Long-Distance Wife

"R" first was given a phone by her husband in 2003: a used Nokia 3310 (later replaced by a motorola c118). In her mid-40s, she manages a farm household with 6 children and grandchildren. Her husband lives away for work most of the year. As an HIV+ woman (living positively and on ART in 2006), she is active in her HIV support group and volunteers as community health care and home-based care worker. Death and disease, plus managing long-distance relationships figure in her conversations about how her phone use. The phone is important for "knowing about people" but and sometimes for finding about prices.

Text messaging is something she just learned: amazing that you just "write a message!" Cost and inconvenience of charging a phone are large problems. Since she lacks cash, she waits for her husband to Sambaza her and says "I never buy any airtime". While expensive, with the phone, at least, you "Can't starve to communicate".

Recent "personal" calls were made to her son in Kitale to buy fertilizer; a stepson in M- to come organize the planting, and her husband in M- city to to ask whether he got treatment. "Work" calls were made to commmunity group colleagues within the village or nearby to "arrange activities", to the treasurer of a group to "organize the sale of our business products. "Community"-related calls were made to an agency in Bungoma town to "know what projects they do" and to nurses at the mobile outreach to "organize VCT".

Data sources: survey, July 2007 interview, personal communication with "R"

Text box 4: Are Small Solar Chargers the Solution?

As part of the study, “R” (see box 3) agreed to try out a small solar charger for her motorola (c118).

The charger—a 1.5 watt, Chinese-made hand-held device, was purchased in Nairobi by the project at Ksh 5000 in May 2007. (Figures 3a, 3b)

“R” reported that it worked well for her for months and saved her from making the trip to town to charge (Ksh 50 and several hours). However, it disappointingly did not work at all for her friend’s handset: evidently the small adaptors that were supplied with the charger did not fit her friend’s phone.

The charger fell and broke in early 2008, but was taken (by the project) in July 2008 to be repaired by a small cellphone repair technician in Bungoma. They report it has been fixed (for Ksh 650) and it is now in use again. The original purchase price and repair were well beyond the budget of “R”.

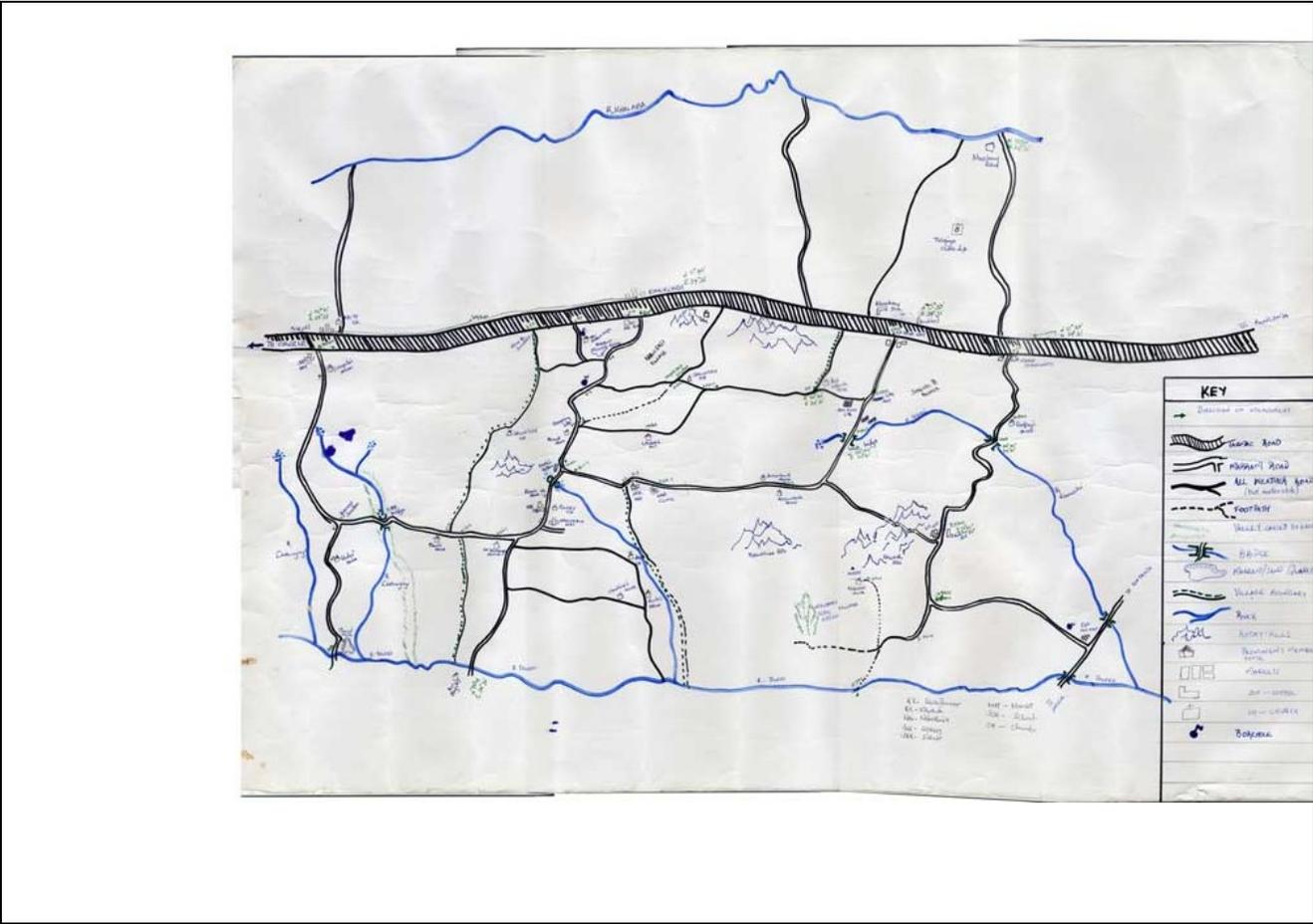


Figure 1. Village sketch map (image reduced: original is 30 in x 24 in)



Figure 2. Typical panorama at the interior of the study site



Figure 3a. Solar Power: charger at "R's" farm



Figure 3b. Solar Charger being repaired in Bungoma town

A Week in the Life of MOTOROLA's Simu ya Mkono

Wiki ya JANO (5)

Si ku	Kupiga Simu	Ujumbe mfuaji (SMS)	Kujaza/kaweka Moto/Bateri	Hali Nyingine?	Shilingi Ngapi?
1 24 15 11	Kupiga: NLIPIKIA, LAURA, SIMU Nia: NILI MUJULISA, NIKO HAPA, MUMBANI, KSH. 10/2	Katama: - Nia: -	Mabili: -	-	Kupiga: KSh. 10/- Katama ujamba: - Kaweka moto: -
2 24 15 11	Kupiga: KUTOKA, KWA, NICKSON Nia: SABABU, NICKSON WIKO, SACARIMI TA, KUTA Nia: KULIKUWA, NA, WANGEMI, KSH. 15/2	Kupiga: ALIWA, DA YUNGE, KUTOKA KWA, LAURA Nia: KUNIDUKISHA, KUFIRA KWAKE, KUTOKA NBI Katama: KWA, LAURA Nia: ALISIWA	TOP UP KSh 100/- Mabili: -	KUNDESHI, SIMU, POWER ON OFF	Zinginezo: - Jumla: KSh. 10/-
3 26 05 01	Kupiga: ROSE Nia: SABABU, KULIKUWA LAURA, KUMU AMEHEKA Kupiga: KWA, NBI Nia: SABABU, ALIWA, LER E BAWA, KWA MUMBA	Katama: - Nia: - Kupiga: AT BAWA, AKO, BODIWA Nia: SABABU, ALIWA, KWA, KWA, KWA	Mabili: - mayanja 2x	PLEASE CALLS ME	Kupiga: 10/- Katama ujamba: 20/- Kaweka moto: 20/- Zinginezo: 20/- Jumla: 20/-
4 27 05 01	Kupiga: KWA, MWA, SIKIWA, KUKUWA Nia: SABABU, KWA, WAKWA, AMEHEKA, KWA, KWA, KWA, KWA, KWA Kupiga: NICK, ANA Nia: SABABU, KWA, KWA, KWA, KWA, KWA, KWA, KWA, KWA	Katama: ROSE Nia: - Kupiga: KWA, NBI Nia: SABABU, KWA, KWA, KWA, KWA, KWA, KWA, KWA, KWA	Mabili: -	-	Kupiga: 15/- Katama ujamba: 5/- Kaweka moto: - Zinginezo: - Jumla: 20/-
5 28 05 01	Kupiga: NLI SAIKI, WA, WANGEMI Nia: SABABU, ALIWA, KWA, KWA, KWA, KWA, KWA, KWA, KWA	Katama: KWA, NBI Nia: - Kupiga: KWA, NBI Nia: SABABU, KWA, KWA, KWA, KWA, KWA, KWA, KWA, KWA	Mabili: -	-	Kupiga: 20/- Katama ujamba: 5 Kaweka moto: -

A Day in the Life of ROSE's Simu ya Mkono

Siku ya Shamba wakura wa 6

Nama ya Simu MOTOROLA

Provider/Network Safaricom

Masa ya Siku	Kupiga Simu	Ujumbe mfuaji (SMS)	Kujaza kwanza Moto/Bateri	Ukuruzi	Mabili pe kwanza moto	Shilingi ngapi (simu/SMS)	Kutumwa na mtu mwingine (simu/SMS)	Fungua kutima	Shida
2-PM	-	KWA LAURA, NICKSON, LAURA	20/-	Alam 7 kusaka 6 PM	-	-	-	7-11 5 AM of 20	Akuna shanda
5-PM	NICK	Anauliza kama furaha kwake	-	nyuma enaisha ama Pando	mayja 20/-	-	-	11 kam of	Shinda ni kuchaku
7 am	-	-	-	Mary Kutesha watu ku wachete tikwiti	-	-	-	of 2-30 PM	Kwa simu ni son
9-19 aai	Rosa, NICK	Hanze wahone kama tena	-	Kwasi, Mary, Kutesha, Agwa, Kutesha, Mary	-	-	-	-	Kila kitu ni sawa
12:50 am	Anna, NICK, NIKE	-	-	-	-	-	-	-	Nimeyi furaha ya sana
2:30 PM	-	-	-	NICK Kutesha kwali ya nyuma	-	-	-	-	Ni kama kuyichanya ni tuchama
5:30 PM	-	-	-	Anna Kutesha amefika ya kukicikula	-	-	-	-	Ni sawa tina chachi
5:43 PM	-	-	-	ALICE A Simu ni wema nina kosi	-	-	-	-	Ni kiba cha chachi ni sawa
6-PM	-	-	-	Kwasi, Mary, Kutesha, Agwa, Kutesha, Mary	-	-	-	-	-

Figure 4. Sample Phone Use Diaries (one week, one day, scaled 25% of original)