Communication, Search, and Mobile Phones:
A Telephone Directory Intervention in Tanzania

REVISED scope of work for BASIS AMA CRSP

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TOTAL PROJECT BUDGET: $134,271

TOTAL REQUEST FROM BASIS: $99,949

In keeping with the suggestion of the review committee, we will use funding from BASIS to establish a proof of concept for the intervention that is central to our initial proposal. The specific goal of the work proposed here is to measure the impact of a listing in a paper telephone directory on outcomes for enterprises that support the agricultural sector in rural Tanzania. Our primary broader objective is to generate preliminary evidence that an information tool that lowers the cost of searching for unknown network members who satisfy specific criteria – such as a telephone directory – is an effective mechanism for increasing communication between rural households and SMEs in sub-Saharan Africa. A secondary objective of the activities described here is to produce a descriptive paper that details patterns of ICT usage, advertising, and customer exposure among firms.

Please see our full BASIS AMA CRSP proposal for a more extensive discussion of the motivation, relevant literature, and broader aims of the overall study.

Introduction

The expansion of information and communications technology (ICT) throughout the developing world is among the most profound and all-encompassing instances of technological change in modern economic history. In the 15 years since mobile phone towers first arrived to rural areas of low-income countries, researchers and policymakers have recognized the potential for ICT to improve service delivery and increase market participation by agrarian households.

Yet, for all the promise of this technological transformation, our understanding of the economic significance of these changes remains surprisingly rudimentary. This is particularly the case regarding the potential for ICT to provide pathways out of rural poverty for agrarian households. Recent empirical work has focused instead on how mobile phones reduce information asymmetries between traders in agricultural markets (Jensen 2007, Aker 2010), lower transaction costs in financial exchange (Jack and Suri 2014, Blumenstock et al. 2013, Aker et al. 2013), or provide alternative savings mechanisms (Mas and Mayer 2012, Mbiti and Weil 2011). Initial trials of top-down SMS-based price and weather information systems, which may provide benefits to the rural poor, were disappointing in that on balance they demonstrated little impact on the choices made or outcomes realized by rural households (Camacho and Conover 2012, Fafchamps and Minten 2012, Cole et al. 2012, Cole and Fernando 2012).[1]

One particular mechanism that is poorly understood is the extent to which ICTs create private returns for smallholders by lowering the costs of both communicating with and searching for suppliers to their agricultural production functions and buyers of agricultural outputs. This is a critical knowledge gap. While it is commonly believed that a major impediment to smallholder

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[1] The exception is Nakasone (2013), who shows that price information delivered via SMS raises the output price received by farmers in Peru. However, the emphasis there is on marketing decisions, not production decisions.

productivity is the underutilization of key inputs, few practical solutions exist to improve communications between farmers and from farmers to suppliers and traders (Griliches 1957, Conley and Udry 2010, Suri 2011, Maertens and Barrett 2013). To the extent that heterogeneous transaction costs impede market participation by large numbers of rural households in sub-Saharan Africa (SSA) (Barrett 2008), and that traditional forms of exchange rely heavily on face-to-face, cash-and-carry trade with prices negotiated on the spot (Fafchamps 2004), mobile telephony has enormous potential to increase market participation and use of improved inputs by linking previously disconnected households to large networks of agents with whom they can interact at low cost.

One possible reason that we have not seen such effects over the last decade is that mobile phones have proliferated without a complementary service providing information about other members of the network. Consider the contrast with developed countries. In wealthy countries, phone users are embedded in an information environment that allows them to form connections and search for phone numbers at low cost. In the early years of landlines, human operators linked callers to other parties based on what we would now call 'search criteria'. Operators were eventually replaced by automated exchanges and telephone directories (Brooks 1976). Today, information for most businesses is readily available on the web, providing agents with an organized list of potential contacts, most of whom would be otherwise unknown.

In developing countries, where no such information services exist, individuals' mobile phone networks are predominantly functions of their face-to-face networks. Phones reduce communication costs between linked agents who purchase phones and exchange numbers, but they do not significantly alter the cost of searching for new contacts. Although it is possible to learn new phone numbers by asking around the village or calling a friend, this type of

information seeking is mediated entirely by one's pre-existing connections. As a consequence, the individual payoffs to mobile telephony, especially in rural areas, may be biased in favor of agents with strong pre-existing networks, higher wealth, greater mobility, and better education. In many societies, particularly those in which men are more likely to travel for trading purposes while women tend to the household and farm, there is likely an inherent gender bias to these returns (Boserup 2007).

In this proof-of-concept study we will measure the extent to which an information tool that lowers the cost to households of searching for firms relevant to agricultural production can increase communication between households and firms. Our primary intervention is a telephone directory that lists descriptions and contact information for enterprises in the surrounding area, which we will construct and distribute to agrarian households in Tanzania. The principal objective of this preliminary study is to measure the effects of the telephone directory on the firms that are listed. We will track a range of firm outcomes, including number of employees, revenues, and profits, as well as the intermediate mechanisms by which those outcomes are realized, such as number of customers, number of phone calls received, inventories, trading volumes, location of activities, and prices. Inference will be based on randomized, controlled trial with experimental variation in the intensity of firm exposure to households.

The findings of this study will have important implications for our understanding of both the dynamics of smallholder market participation and the growth of agricultural SMEs in an era of rapidly changing information and communication technologies. The preliminary evidence from the research described here will provide important guidance for future research in this area.

Research question

Although our study is a proof of concept and any evidence will be considered preliminary, our objective is to answer the following research question: **What impact does a directory listing have on treated and untreated firms?** We will use experimental variation in the intensity of firm exposure, as measured by variation in the number of directories distributed that list the enterprise, to measure the effect of a directory listing on key firm outcomes such as phone calls received, revenues, number of employees, number of customers, and location.

Data collection and survey activities

The universe for this study is the population of enterprises that provide goods or services relevant to agricultural production in the Dodoma region of Tanzania. At the outset of our study we will conduct an enterprise census to construct the phone directory. The research team will employ a combination of activities to promote directory registration: posting advertisements in public places, going door-to-door to solicit entries, setting up registration tables at market centers and bus stands, and working through town officials and other key local persons. Since the creation of a formal registration process for mobile phone numbers in 2009, phone number "churning" rates have fallen and we expect most enterprises to have a stable contact number through the duration of the project.

We will list all willing enterprises related to any aspect of agricultural production in the study area. This covers traders, transporters, input suppliers, veterinarians, extension agents, cooperative societies, banks, moneylenders, health clinics, pharmacies, general stores, market

vendors, and others. Extra efforts will be made to include informal enterprises that might be missed by a formal enterprise survey, such as organized crews of laborers, individuals who rent out tractors or draft animals, and transporters with bicycles who carry crops between farm gate and market.[2] The enterprise census team will prioritize firms from 5-7 trading towns that serve rural areas in Dodoma region, as well as relevant firms from Dodoma city. We expect to enroll 1,400-1,800 firms for the directory. In scaling down the enterprise study to fit the revised budget we have opted to cut primarily on the extensive margin. That is, we will focus on a smaller geographical area than originally proposed, but for that area the directory will be as comprehensive as possible.

After completion of the census we will stratify firms by sector (e.g., large transporters, agro-vets, labor crews, etc.) and randomly select 400 firms for participation in the study. Within each stratum firms will be randomized into one of four arms: Control (C), Low Treatment (L), Medium Treatment (M), and High Treatment (H). We will print and distribute a total of 2,000 directories, including firms in the following way:

- Control (C) (N=100) These firms will not be listed in the directories.
- Low Treatment (L) (N=100) These firms will be listed in 500 directories.
- Medium Treatment (M) (N=100) These firms will be listed in 1,000 directories.
- High Treatment (H) (N=100) These firms will be listed in 2,000 directories.

Firms listed during the enterprise census but not selected for the study will still be included in all versions of the directory. This is to ensure that the information tool that we provide to

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[2] Without a simultaneous household survey it will be more difficult for us to locate informal enterprises that are based in villages or that are only active seasonally. Nevertheless, through snowball sampling and targeted visits to villages in the study area we expect to locate and list many of these informal firms.

households as part of this preliminary study is similar to that which would be provided as part of a larger intervention or public service.

The directory will list firms alphabetically by town, category, and name. See Figure 1 for an example. Standardized terminology will be used to describe firms, and a two-letter code for the mobile phone carrier will be printed next to the phone number ("VD" is for "Vodacom" in Figure 1). A total of 2,000 directories will be printed and distributed quasi-randomly to households in villages around the census trading towns. A stationary company in Dar es Salaam will print the directories on durable paper. The directory will be in Swahili. We will carefully track the cost of producing the directory so as to assess the scalability of the intervention through comparison with any measurable benefits that accrue to firms.

Figure 1. Example of Telephone Directory Listings

MUFINDI
General stores

Enterprise	Proprietor	Brief description of activities	Address	Phone number
Benny Bazaar	Kamkulu, John	Dry goods, eggs, grains, kerosene	41 Iringa Rd	0756201501 VD
Calesto Shop	Julius, Calesto	Dry goods, grains, seeds	Bus stand	0684000879 VD

Before distributing the directories we will conduct a baseline survey with the 400 study firms. The survey will cover key firm characteristics including number of employees, services provided, operating hours, inventory, capital, revenues, credit, and profits. We will also gather detailed data on customer arrival rates, perceived demand for firm services, advertising, location of activities, and use of ICT.

We will employ a combination of activities to track outcomes for study firms. First, we will conduct two follow-up phone surveys with each study firm during the 6 months after distribution of the directories. In these follow-up surveys we will measure relevant outcomes such as customer arrival rates, incoming calls, revenues, and profits, as well as subjective assessments of enterprise performance. The PIs have extensive experience conducting surveys of this type in Tanzania, and we are confident that most firms will be reachable.

Second, each study enterprise will be provided with a Phone Call Log sheet. We will ask firm managers and staff to mark the sheet each time they receive an incoming business-related call on the telephone number provided in the directory. While these log data will surely be noisy, they will represent a novel and important form of data on ICT and communication activities for firms in Africa. Measurement error in completing the log will likely be correlated with firm type – e.g., self-employed bicycle transporters may have more difficulty keeping the log sheet up-to-date than shopkeepers who already maintain inventory logs and who have an indoor office – however, stratification by firm type prior to assignment to treatment arms ensures that such error will not introduce bias into our measures of treatment effects. Furthermore, Adalbertus Kamanzi (Proposal PI) encountered universal enthusiasm for participation in a telephone directory during scoping interviews with 73 firms during 2013. We therefore expect that most firm managers will be enthusiastic to support the project by maintaining the log sheet.

Third, we will use Frontline SMS software to regularly send text-based prompts to firm managers. These prompts will ask for a return SMS reporting the number of business-related phone calls received in the past 3 days, using a standardized format. We will provide firm managers with training and an instruction sheet detailing the format for these SMS replies. In recent years this form of data collection has proved successful for surveys dealing with high

frequency measures of simple, quantitative outcomes.[3] These SMS surveys will complement the log sheets, acting as both a key part of data collection and a prompt to remind firms to track their phone-based activities. During baseline survey visits, firm managers will be provided with compensation for the (albeit negligible) cost of sending SMS replies.

Fourth, we will conduct a follow-up visit to each study firms 6-8 months after the baseline survey. During the follow-up visit we will conduct a short survey covering the same details as the baseline survey, and collect the Phone Call Log sheets.

Finally, at the end of the project we will distribute approximately 2,000 revised versions of the directory that include all participating firms. This will ensure that if there is indeed a large effect on firm outcomes from a directory listing, control firms are not disadvantaged in the long run because of their involvement in the study.

Connecting data to the key research question

To estimate the magnitude of the intervention we will compare outcomes for firms in the L, M, and H treatment group with those in the C group. Regressions will include both sector dummies and interactions between sector and treatment dummies. If we detect significant impacts on firm profits, we will use the estimated effect to calculate basic measures of willingness-to-pay for a directory listing.

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[3] See the website of Frontline SMS, http://www.frontlinesms.com, for information on successfully implemented projects.

Location and timeline

The study will take place in rural areas of Dodoma region, Tanzania. We have chosen to work in Dodoma rather than Iringa, as originally proposed, because Adalbertus Kamanzi (proposal PI) and our expected enumerators are based in Dodoma and so can participate in field activities at lower cost. Also, moving location preserves the original study area for potential implementation of the full project in the future. Although agrarian households in Dodoma may be less isolated on average than those in Iringa, this is still a rural agricultural area with relatively poor infrastructure and high average transaction costs. We are confident that if the hypothesized effects exist, they can be detected in this setting.

The enterprise census will take place from late June to early August 2014. Directory printing and the baseline survey will take place in August 2014. Directories will be distributed to households in the first week of September 2014. The follow-up phone survey will be conducted during the period October 2014 - March 2015. In-person follow-up surveys with study firms will take place in March-April 2015.

Budget overview

Please see the attached spreadsheets for budget details. An itemized budget with exact cost estimates for all field activities is available upon request.

All BASIS funds will be used to support data collection activities in Tanzania, other than those to pay travel costs for a US-based investigator to participate in the BASIS technical meeting. Two graduate students – one from the US and one from Tanzania – will be hired in summer 2014 to take lead roles in managing the project. These students will handle the day-to-day aspects of the field surveys and intervention delivery. We will hire 3-5 additional graduate students from Tanzanian universities to work as enumerators.

All of the time contributed by US-based investigators will be cost-shared. This includes a 2-3 week visit to the study area in summer 2014 by two of the US-based investigators, a return visit by the PI in 2015, regular Skype meetings by survey team members, ongoing support and monitoring of the data collection activities, data analysis, and manuscript preparation.

ANTICIPATED OUTPUTS

We will meet with government officials and USAID Mission in Tanzania at the outset of our study, to describe the project and discuss ways to integrate our findings with other government and USAID activities. We will keep these groups apprised of the outcomes of our project.

Because this is a proof of concept study, one of our primary objectives is to use the preliminary findings of this research as a starting point for a larger, longer term study of the impacts of a telephone directory on both the firms that are listed and the households that receive the directory. If we are able to demonstrate that a telephone directory is an effective tool for increasing communication between households and firms, we will write additional research proposals requesting support from both government and private foundation sources. The objectives of those larger proposals will be similar to those described in our initial BASIS proposal. Those proposals will benefit significantly from the preliminary evidence generated by the project described here.

We expect to publish at least one academic paper from this project, describing patterns of ICT usage, advertising, and customer exposure among enterprises related to agriculture. This paper will be targeted at a development field journal. If the treatment effects that we estimate are significant enough to merit publication on their own, we will write a second academic paper describing the outcomes of the directory RCT. This paper will be targeted at a top general interest or development field journal.