

AppLab Question Box: A Live Voice Information Service in Rural Uganda

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Abstract—This paper is a study of the pilot of AppLab Question Box, a voice telephony-based information service for the rural poor implemented in two districts in Uganda from April through September 2009. The purposes of the pilot were as follows: to test the interest and viability of a live agriculture/general hotline to rural Mbale and Bushenyi districts in Uganda; to understand the informational needs and interests of the target population; and to compare a live, voice-delivered information system against an alternative, SMS-based query system.

AQB provided a unique view into the needs and interests of the target populations, and permits study of the demand for information to support livelihoods as well as pure curiosity. It demonstrated that a small scale, live, local language telephone hotline about both specialized (agriculture) and general information was possible to run with simple, inexpensive infrastructure. Finally, it permits exploration of issues of trust surrounding information provision and the role of intermediaries in facilitating it in this setting.

Index Terms—ICT, development, cell phones, Uganda

I. INTRODUCTION

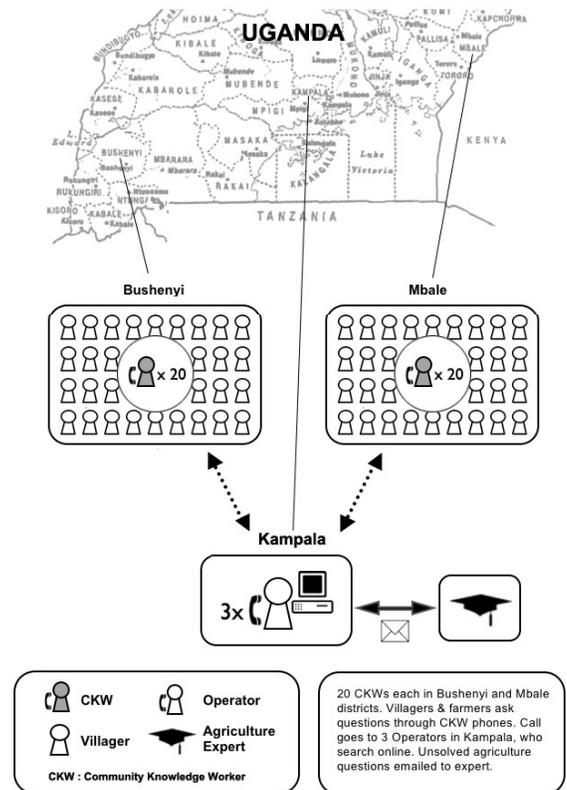
This paper is a study of the pilot phase of AppLab Question Box (AQB), a voice telephony-based information service for the rural poor implemented in two districts in Uganda from April through September 2009. It was a collaboration between Grameen Foundation’s AppLab in Uganda, and Open Mind, a nonprofit organization with telephone hotline experience providing a similar service in India.

Grameen built a network of 40 local field agents in two Ugandan districts – Bushenyi and Mbale – each outfitted with a mobile telephone and specialized training. Grameen was exploring how this network of agents, dubbed Community Knowledge Workers (CKWs), could improve the quality of life and access to information for area residents, particularly farmers. One avenue that was explored was the offering of a live, local language telephone hotline to the populace, via the CKWs. The 20 CKWs in Bushenyi presented the hotline as an agricultural hotline, whilst the 20 CKWs in Mbale described it as a broad, cross-topic informational hotline.

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Uganda; to understand the informational needs and interests of the target population; and to compare a live, voice-delivered information system against an alternative, SMS-based query system.

Open Mind provided the agriculture and information hotline service to the Grameen CKWs. Open Mind retained three operators, who were women fluent in seven dialects plus English, to answer the questions from Open Mind’s base in Kampala. Each operator was outfitted with a laptop connected to the Internet, which worked intermittently. The laptops also had access to local databases of agricultural and other information, provided by Grameen Foundation and Open Mind from third parties. Each operator also each had a mobile phone to receive the query calls. The overall effect was to run a small-scale call center from an ordinary office. The vast majority of calls originated from CKWs, although near the end of the pilot, a handful of individuals called from their personal mobile phones.



AppLab - Question Box Hotline Schematic

Implemented: April 09- Sep 09

Fig. 1 – AQB Schematic

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Operators received calls five days a week, from 9am to 5pm. Using a proprietary Open Mind software system, they tracked the CKWs placing the calls, their topics, questions, the answers given, and the source of those answers. They also tracked the amount of time it took to find the answer to measure service quality. If a question could not be answered within three minutes, the operator would apologize, hang up, and call back within 15 minutes. If the answer was still not found, and if the question pertained to agriculture, the query was sent to an agriculture expert retained by Grameen. Answers were returned within four working days.

II. METHODOLOGY

This paper's purpose is to examine the Question Box live voice hotline, both in terms of its design and theoretical basis and through a study of the project's extensive call data findings.

Its design and context are best understood through discussion of similar information services, giving special attention to its use of the medium of voice telephone, and the role of intermediaries (the CKWs and the Question Box operators) in the process. Therefore, we will begin with a short review of relevant literature. This will be largely rooted in the ICTD discipline's literature on similar information services through various media such as SMS and radio, with particular attention to those employing audio in the form of recorded voice and controlled by speech. However, among these, the presence of active intermediaries (on either side of the phone) is somewhat unusual.

In our study of the project's own findings, our discussion is based in large part in an ethnographic needs assessment [1] that preceded the Grameen Foundation's CKW project and to their adoption of CKW-mediated information sources deployed in Uganda, including Question Box. Question Box's database also catalogued every question asked, providing an invaluable window into the type of information demanded by the CKWs' clients. Finally, the authors' interactions with CKWs in the field and participation in Grameen-organized focus groups provide tremendous insights into their perceptions and use of the service, and their views of their clients' needs and desires for information.

Our methodology is necessarily variable, as our primary material about the project takes a variety of forms. The authors' interaction with the project's participants and stakeholders was too limited in duration and in scope to permit true ethnography; by the same token, the volume and nature of the question data does not lend itself to quantitative analysis beyond simple categorization. However, having access to the ethnographic insights of the Grameen needs assessment [1] yields an excellent opportunity to implement an information needs/mapping-style assessment, as described by Heeks and Molla [2], in which the needs established prior to the project's implementation are studied in light of the information demanded by users of the project and its outcomes. However, our goal is not, nor does our data permit, a complete impact assessment. Therefore, we endeavor to examine the project holistically in an effort to gain insight into both the demand

for information and the significance of the way in which the users are connected to the answers to their questions.

III. LITERATURE REVIEW

The mobile phone, the medium through which Question Box's operators are connected to its users, has come to occupy a privileged place in development, in which it has come to be accepted as a promising tool for poverty reduction in a variety of different capacities, such as reducing transport and transactions costs and strengthening social and business ties across great distances.

A useful starting point in organizing this literature is Donner's review [3] of literature on mobiles in development. In it, he examines a selection of relevant studies from different disciplines and based upon different approaches. In this case, we are interested primarily in what he classifies as *impact studies*, those that examine the social or economic effects of mobile access, and *design studies*, which propose new uses or interfaces for mobiles and mobile applications, or assess existing ones.

Turning first to impact studies, several authors have established that the mobile phone is an effective tool for leveling markets. Jensen's "The digital divide: information (technology), market performance, and welfare in the south Indian fisheries sector" [4], is a fundamental article arguing for the value of the mobile phone as an information source in a development context. Jensen describes the economic effects of mobile phone access on the fishing industry in Kerala, India. He observes the performance of the market over time, beginning when the mobile phone is extremely rare, through its widespread distribution, and demonstrates that the freer flow of market information lead to prices stabilizing and substantial declines in waste and spoilage of fish.

Aker's "Does digital divide or provide?" [5] is another economic study of the effects of cellular phones on market performance, in which the author uses grain market data from Niger to demonstrate that as cellular phones became more widespread, prices across markets became less dispersed, although the effects on farmers' welfare could not be assessed directly.

This makes a strong case for the mobile phone as a tool for information access, specifically wider and more rapid access to market information among participants in the market. In Indian deployments of Question Box, produce and commodity market prices are a dominant, self-selected use of the open-ended system by users. In Uganda, remote market prices were not available to the system, although farmers occasionally asked about prices in spite of this.

Therefore, we will turn from what Donner [3] classifies as impact studies into his design studies—that is, studies that examine the design of either the technological artifacts (in this case, mobile phones) themselves or that of applications for them. In this case, we are considering information services as applications, and in particular one for which the user interface is a voice conversation with a live operator.

In [6], Donner presents a useful overview of services he terms "mobile-based livelihood services." He discusses market information services for price information, virtual marketplaces to connect buyers and sellers directly,

agriculture extension services that provide similar information to traditional extension work, financial services such as mobile banking, and direct livelihood services, such as Grameen's Village Phone, which is a self-contained mobile phone kiosk business. Among the services listed, the vast majority are SMS-based, a trend Donner ascribes to its broad availability and relatively low cost, although the only alternative discussed is mobile internet, with no consideration of voice. Question Box, however, is such voice-based a service.

Voice and Voice Recognition

In many countries, illiteracy rates top 50%, and are even higher for women, making voice the only way to connect with large portions of the population. As such, there has been significant interest in designing services and applications for partially or completely illiterate users with little to no experience with information technology. These interfaces may be implemented in a variety of ways, such as on-screen graphics, other visual guides, audio prompts, and fully voice-based systems.

Among these, [7] and [8] address the general topic of designing interfaces for illiterate users, although their focus is on visual interfaces for computer systems. Of particular interest to our study, however, are those that deal with the use of voice. Many examine the potential of interactive voice recognition (IVR) systems as user interfaces for information services, typically consisting of recorded audio content or text-to-speech reading of text content, targeting illiterate users in much the same fashion as Question Box, although without the use of a live operator.

Reference [9] extends this more specifically to development, and asks (although does not necessarily answer) important questions surrounding localization. Sherwani *et al.*, [10] and [11], apply IVR techniques to accessing Wikipedia and health information, respectively. The health information provided in this case came in the form of pre-recorded readings of approved health sources in the local language, and was specifically designed to serve as a resource for Community Health Workers (CHWs) in Pakistan.

Two notable articles, [12] and [13], deal conceptually with the idea of IVR interfaces as a useful interface for services specifically targeting farmers, and examine the complexities of accurate voice recognition between different regional dialects, a technical problem avoided entirely by the use of human operators.

In general, these case studies demonstrate the value of voice as an interface for illiterate or semi-literate people, particularly the rural poor, although they deal primarily with the technological issues of handling voice other than with a human operator. From these, we may conclude that the voice interface is a highly effective means of freeing useful information from the requirement of literacy. However, the trend in this research is toward automated systems because of their lower ongoing costs.

Many of the works mentioned here that deal specifically with the creation of services or applications (used here loosely, indicating both software and services), come from a heavily technical and theoretical standpoint, and in general do not exhibit the type of ex-post analysis we endeavor to accomplish with regard to Question Box. Furthermore, the

nature of their systems does not permit the complete openness of questions possible through human interaction, and they therefore do not present the window into information demand Question Box permits. The detailed information needs mapping provided by a service such as Question Box may, on the other hand, usefully inform the creation of such services.

Trust and Intermediaries

In the library and information science discipline (LIS), a separate body of literature exists dealing with the role of the reference librarian as gatekeeper and interpreter of information, specifically in the form of answers to client questions (c.f. [14]). This role, then, is quite similar to that of the Question Box operator (*vis-à-vis* the CKW) and the CKW, to the original client. This calls attention to the potential of the intermediary both to influence the questions asked and to frame the answers given in a biased or inaccurate fashion. While Question Box's use of the phone to connect the rural farmer to what is, in effect, a reference desk, does present these problems, its orientation toward practical, factual information reduces the potentially problematic influence intermediaries can have. This could be more significant were health questions within the service's purview.

The role of the intermediary is also closely linked to the users' perception and trust of the service and the information it provides. In particular, Molony [15] and Overå [16] deal with this issue, although with regard to communications (between individuals and businesses). Nevertheless, they emphasize the role of face-to-face interaction in business relationships requiring trust, and demonstrate the relative mistrust of the voice at the other end of the phone.

In terms of information sources, Srinivasan [17] also addresses this issue with respect to agriculture information kiosks in Tamil Nadu, India, and demonstrates that the factual information (e.g., prices) from the kiosks was readily trusted, but information perceived as advice (e.g., best farming practices) was much less readily trusted when received from an unknown source.

These demonstrate the value of a trusted intermediary in the provision of information. Question Box is designed not to require an in-person intermediary; the operator can interpret the user's question and format the answer (both in terms of language and complexity) for the user in real time based upon their interaction with the user. The community-level, in-person intermediary is much more important when dealing with media that are more difficult for the rural poor, such as SMS, with its greater demands on the technological skill and literacy of its users.

Nevertheless, AQB as implemented in Uganda forms a middle space, as there are intermediaries on either side of the phone. Despite their status as CKWs and place within their respective communities, many described their clients as initially suspicious of the information services they offered. Over time, this mistrust abated as the information proved to be useful. As such, the presence of the CKW validated the distant operator. In essence, the trust of the CKW was successfully transferred to the operator. In delicate cases, the operator was sometimes a preferable intermediary, as it was both trusted (due to the introduction via CKW) and anonymous.

IV. PROJECT DESIGN

The technologies upon which the project is based are simple and inexpensive. At the user/CKW end, simple voice-capable cellular phones are the only requirement. In the pilot implementation, the operators took calls on simple desktop cellular phones (the same handset as used for the MTN PayPhone and Village Phone services). CKWs had the numbers for all three operators' phones and could call any, depending upon availability. Larger scale implementation would, of course, require a more elaborate call-center design.

Besides this, the operators used standard Windows computers for the desktop client, and a Linux server ran the backend component. Neither requires expensive or modern hardware; the pilot employed older, used hardware quite successfully. The client software is a Java interface built by local Ugandan developers at the Kampala-based software company where the project was housed. It was designed for operation by computer-literate users, as the operators' job necessitates a relatively high level of competency in computer and internet use.

The server side was a relatively simple MySQL database, structured to accept raw data in a variety of standard forms, questions referred to experts, and all questions asked. Primary system requirements are sufficient and reliable storage capacity, and whereas it benefits greatly from an Internet connection, it can be operated with only a local database.

When a call was received, the operator answered it and generated a new record, as the CKW asked a villager's question, and the operator repeated it to confirm. On the search screen, the operator entered keywords from the query into a search field, and searched for existing, locally stored information pertinent to the question.

If applicable answers were present, they appeared in the results. The operator responded to the caller based upon the previous response(s) to that question, and clicked "Log Query" to proceed to the call recording screen. If no relevant answers were found, the operator searched with the same keywords but expanding the search online; again, if possible the operator told the caller/CKW the answer to the question. In this case, the answers were added to the database and did not need to be retrieved from the Internet again. For topics not

covered in the database, operators searched the web directly using Google. If an answer still was not found and was agricultural in nature, it was escalated to the expert. Otherwise, it could not be answered, and the CKW was informed.

Once the call was finished, the operator entered the rest of the relevant information about the query (e.g., CKW name and phone number, district). The system recorded the time of the call and associated it with the selected answer, minimizing the manual input required of the operator. These records provide the question data upon which this research is based.

The most difficult components to create and use of other similar projects are almost invariably those dedicated to interpreting user input, such as SMS parsers, IVR systems, and so forth. Question Box sidesteps these entirely through the simple, although costly, use of a human operator. However, using live operators also provides another advantage in the ability to change processes mid-stream and adapt dynamically to changing circumstances, whereas automated approaches depend upon preparing and programming for all possible use-cases in advance.

Approved sources

The database began with data from a variety of sources approved for use by the project's partners, the Grameen Foundation's AppLab. These included information from National Agricultural Research Laboratories Research Institute (NARLI), National Agricultural Research Organisation (NARO), and Agro Tech.

On certain time-sensitive topics for which cached and approved data was neither necessary nor logical, operators searched the Internet directly without searching the local database. Questions handled in this fashion included sports scores, news, and most historical/political questions.

Finally, the project's agreement with the Grameen Foundation and NARO permitted agriculture questions to be forwarded to an expert, a NARO agronomist with a Master's degree from Makerere University, who provided answers within four working days via email.

The project's initial scope also included health questions, and a database from Marie Stopes was integrated into the backend. However, the project's organizers and partners

Table I: Comparison of ICTs as media for information sources

Technology	Costs	Ubiquity	Interactivity	Ease of Use
Live voice hotlines	Low setup; high operating. High for users if they pay.	High	High	High
SMS Queries	Medium-high set up; low operating	High: most existing phones are SMS-capable	Medium: response can be human or automated	Low: SMS search requires careful wording
Radio	Low	High	Medium: call-in shows common	High
In-person Agents	High	Low	High	High
Interactive Voice Recognition (IVR) by phone	Medium-high set up; low operating	High	Medium	Low-medium. Users often not familiar with IVR.
Television	High	Medium	Low: call-in shows less common than radio	High

ultimately judged the liability too great, and all subsequent health queries were answered with advice to seek a medical professional, along with tips on finding the nearest one using a Grameen/Google-provided SMS directory. In spite of the health question ban, a significant portion of questions continued in this vein, exposing a tremendous unmet need for medical information.

Cost and the Voice Medium

As discussed above, live voice services are relatively unusual in ICTD settings. However, their ubiquity, ease of use, and interactivity make them an effective choice for reaching an audience that has relatively low literacy rates and is dispersed over a wide, rural area. We compare the voice medium with other available ICTs in Table I above.

A serious concern, however, in the implementation of such a system, is the cost. Calls between MTN cellular phones, used on both ends, cost 320 Ugandan shillings (approximately US\$0.16) per minute, for calls lasting up to three minutes and sometimes requiring a call back. During the pilot, airtime was provided by Grameen and therefore free to users, encouraging heavy use. Whether this use would continue were more of the cost shifted to the service's clients is unknown, although it would likely decline, as discussed below along with other CKW observations.

CKWs used around 20,000 shillings per week (US\$10), and occasionally as much as 40,000 shillings in airtime. All told, the cost per question answered over the duration of the pilot (including operator salaries and connectivity, but not the volunteer Program Coordinator) was extremely high, at close to US\$2 per question.

By way of contrast, Google's SMS service was launched free of charge, although slated to be charged at a rate of 130 shillings per message sent (US\$0.07), with no cost to receive the response. Thus, the cost to users is much lower compared to the cost of airtime to call Question Box, were they to call using their own purchased airtime. The operating costs of Google's service are not publicly available.

The second weakness was length of time to answer the query. If the initial call lasted up to three minutes and an answer had not been found, the operator called the CKW back after 15 minutes. If an answer still had not been found, the question was deemed unanswerable, unless it was agricultural in nature, in which case it was forwarded via email to the expert, who had four working days to reply. Upon receipt of the reply, the operator called the Community Knowledge Worker back, who then delivered the answer to the questioner. Eventually the CKWs were trained on the use of voice mail, permitting returned calls even when out of cellular service, and enabling them to store the messages to play back for the clients. However, voice mail is not common in Uganda, and was not intuitive for the CKWs, nor was it automatically enabled on their phones. The CKWs had to manually enable each of their voice mail accounts, adding time and trouble.

This somewhat cumbersome three-level call infrastructure emerged out of the constraints of the database contents, connectivity, and the expert's schedule. A full-time expert was beyond the project's funding, but would presumably result in faster responses in a larger scale implementation.

V. FINDINGS

Over the five-month pilot, the service handled approximately 3,000 questions in total from the two districts served, Mbale and Bushenyi. Exact counts by district and category are displayed in Table II. The operators categorized all of the questions into set categories: agriculture, agriculture prices, education, reproductive health, other health, history, new (other), news, politics, and sports.

Table II:
Questions received by AQB by category

Category	Bushenyi	Mbale	Total
Ag. prices	7	24	31
Agriculture	866	1044	1910
Education	42	153	195
Health, reproductive	17	42	59
Health, other	60	128	188
History	31	117	148
New (Other)	15	97	112
News	33	103	136
Politics	22	76	98
Sports	22	88	110
Total	1115	1872	2987

In both districts a majority of questions were agricultural, although the proportions vary markedly between the districts. This is primarily because AQB was marketed as a source of agricultural information in Bushenyi, whereas in Mbale it was marketed as an all-questions-answered service. This was reflected in print marketing materials (e.g., posters and flyers) as well as CKW presentation of the service. Nevertheless, all types of questions received from Bushenyi were handled normally. Predictably, agricultural questions comprised a larger majority of questions asked from Bushenyi for the duration of the pilot than in Mbale.

While the substantial demand for agriculture information makes sense in both locales, the service's use in Mbale calls particular attention to a demand for a wide variety of information beyond that simply tied to livelihood.

Information Needs

The Grameen needs assessment [1] is a thorough examination of the role of the mobile phone in rural Ugandan life, as well as a study of the demand for information among the rural poor. It was commissioned by the Grameen Foundation's AppLab in preparation for the creation of their Ugandan services, and led to the creation of the CKW program and the pilots of the information services employed by the CKWs, including Question Box. This document provides the necessary background to permit us to use information needs/mapping techniques to examine the outcomes of Question Box.

It notes the ubiquity of the mobile phone and therefore its suitability as a tool for Grameen's mission, and found that reducing transportation and transaction costs of trade was one of the most important uses, much as described widely in the literature. These uses were primarily based upon contact

among individuals. However, the concept of the phone as a convenient way to seek expert advice was already noted, particularly with regard to health information.

Most interesting, however, is its attempt to assess the needs and desires for information. This proved an unexpected challenge. Its authors describe the extremely limited access to outside information—primarily through radio or through physical transportation, such as bicycles or boda-boda motorcycles—and low literacy. Furthermore, they found that the notion of information in the abstract was in some cases difficult to convey. This is not to say that there was no desire for information or that people did not seek it out, but that the concept of it as used in our discussion of this and related projects did not have a direct correlate in local languages.

In their discussions, the researchers arrived at an understanding of the rural Ugandan concept of information as existing somewhere between advice or training, received directly from another individual, and news, factual information on current events. This sense of news also differed slightly from our own, and was in many cases tied directly to material needs (e.g., “news on getting a health center near this community”).

This notion of advice is extremely important, and shows the tremendous value of mediation in this context. Knowledge on topics such as farming techniques is taught and learned on an individual basis, and this one-to-one transfer is implied in the use of the word for advice. Therefore, aside from the (also important) function of interpreting questions and structuring responses appropriately, the intermediary serves to package the information in a way that is comfortable to its user. This also speaks to the issues of trust raised by [15] and [16]. Additionally, CKWs themselves repeatedly described situations in which their clients were initially skeptical or suspicious of their ability to provide useful information and their motives for doing so, as discussed below.

Once again, the presence of both the CKW and the Question Box operator in this case make it difficult to assess whether the remote intermediary (the operator) can effectively serve in this capacity. However, the CKWs’ greater general comfort with the voice service than with SMS services offered alongside AQB suggests that this is the case, and that the human contact, even if remote, does make the service more culturally appropriate.

In addition to its examination of understandings of information and means to connect people to it, this document also enumerates many of the livelihood activities observed in rural Uganda and looks for demand for information related to those. Our call records, conversely, provide a window into exactly what information users demanded, without context.

Burrell identifies four distinctive forms of income generation that, in various combinations, characterize the livelihoods of their cross section of rural Uganda. These are agriculture, trade, small-scale manufacturing, and service-based businesses. Of these, Question Box was able primarily to provide information useful to agriculture, and, to a lesser extent, trade. Few if any questions catalogued can be readily associated with service or manufacturing trades.

While the report does not explore which, if any, of these activities are more or less able to benefit from improved flows of information, it does conclude that any information provided

from outside sources must be actionable in order to be useful. For example, an existing market price service (via SMS) was noted to frequently provide out-of-date information, and did not help match buyers and sellers, and therefore was of little practical value.

Information on agricultural techniques, unlike on trading conditions, is not particularly time-sensitive, and may be assumed to be more universally actionable. This may account, at least in part, for the heavily agricultural slant of the questions answered by AQB. It is also, of course, inextricably bound to the service’s marketing and its presentation by the CKWs themselves.

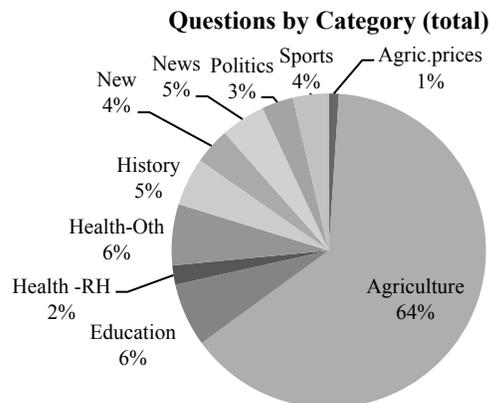


Fig. 2: All AQB questions by category

As shown in Fig. 2, a substantial majority of the questions received (64% overall) were agricultural questions, with other categories comprising the rest in relatively similar proportions (none greater than 6%). This clearly demonstrates that agricultural information is in high demand, and that most users of the service are primarily interested in information related to this aspect of their livelihoods. However, there is also a clear demand for information on other topics, including health.

While agricultural questions still make up a clear majority of calls from Mbale (56%), as shown in Fig. 3, in Bushenyi, they comprised 78% of questions (see Fig. 4). In both cases, demand was evident for information on a variety of other topics, ranging from health to sports to politics. This large difference in proportion shows that the service’s marketing and presentation by CKWs has considerable influence on demand. As such, the freely asked questions from Mbale provide the most interesting window into this demand, and reveal a degree of curiosity not exposed by the livelihood-centric needs assessment.

The great many questions posed by users simply out of curiosity provide an excellent window into what else rural Ugandans would like to know. Many asked questions about history, politics, or sports. Some asked questions to which they knew the answers to test the service. When certain CKWs visited schools in their villages or parishes, the call center was flooded with questions about Ugandan history, heads of state of countries all over the world, the US election, computers, and so on. The open-ended nature of the service, along with its

provision free of charge to users during the pilot, made it possible to expose this desire for knowledge.

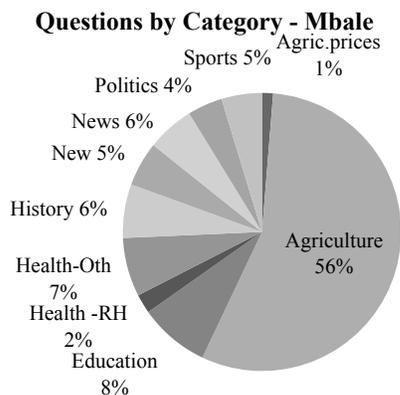


Fig. 3: Questions from Mbale district by category

It is clear that AQB's potential to augment existing information flows is considerable; however, it is less clear for which aspects it is best suited. For non-time-sensitive, technical data, such as on agriculture techniques, that may be entered and stored in its database, it proved effective and popular. It did not, however, provide time-sensitive information such as market data. Nevertheless, for a great many in the communities served by the pilot, this information was useful and well received, as elaborated enthusiastically by the CKWs themselves.

Compared with SMS services launched at around the same time by Grameen and Google, AQB provided an open-ended knowledge solution that lent itself to elaborate or difficult questions on livelihoods topics, but that also permitted a freer expression of curiosity and met an as yet unmapped demand for general knowledge. The SMS solutions, however, appear better suited to some of the other needs identified by Burrell, such as up-to-date, actionable market data and matching potential buyers and sellers in the market.

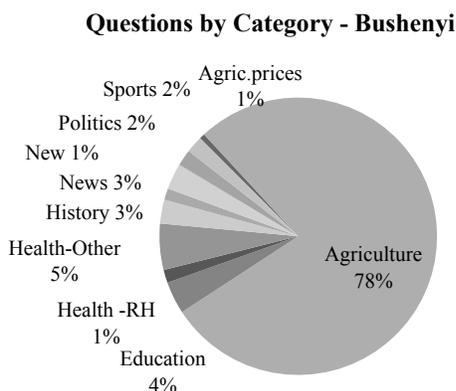


Fig. 4: All questions from Bushenyi district by category

Anecdotes and Example Questions

The immediate impact of AQB was at times quite significant. For instance, a young man a village with AQB service saved all his earnings to invest in piglets. When people learned about the spread of swine flu, they advised him to kill

his pigs. The local CKW called AQB on the young man's behalf, and subsequently learned that swine flu is not spread through pigs, and furthermore, that the disease had not been detected in Uganda. The young man was relieved and continued rearing his pigs. In another instance, a woman called because her teenaged daughter had been hemorrhaging blood for several days. The operator advised them to visit the hospital immediately, regardless of time and money required for transport. Upon arrival, they discovered that the young woman had received a botched illicit abortion; her life was saved at the hospital.

Below is a list of sample AQB questions, taken at random:

- What causes yellowing of leaves of beans?*
- What are the causes of asthma?*
- Who is the minister of education for Uganda?*
- What is the difference between goat dairy milk and cow dairy milk?*
- How many Christian schools are there in Uganda?*
- When the groundnuts are uprooted there are no seeds but only empty husks cause and control?*
- What are the signs of gonorrhoea?*
- Who is the captain of Arsenal?*
- Which is the best month for planting watermelon?*
- How will it affect Egypt when the River Nile is diverted to irrigate Karamoja?*
- A secondary-6 student wants to invest but he has only 100.000 shillings, how can you help him invest in something good without getting a loan?*

CKW Feedback

As CKWs placed the vast majority of calls to the service, as well as interacting with its beneficiaries directly, they were extremely well placed to provide insight into the program's value and impact in a way the authors could not. Focus groups and trainings provided an opportunity to discuss the service and compare it with the other information tools at their disposal.

The CKWs considered the service's flexibility its greatest strength. They could ask elaborate questions and clarify them midstream in a way that was impossible with SMS query services, such as Grameen's internal, proprietary CKW search and Google SMS. They also expressed enthusiasm over the operators' language skills. Between three operators, answers in seven languages were available through Question Box. This also permitted the use of native words by CKWs when dealing with technical and agricultural concepts for which they did not know the English terms.

CKWs' chief complaint was the slow turnaround (up to four working days) on escalated questions. This was irritating to farmers who expected immediate answers, as well as to CKWs whose cellular network coverage was often spotty. The most crucial issue surrounding this was one of trust: CKWs noted that initially their clients did not all believe their ability to answer questions, and thought the CKWs were attempting to sell them something or were otherwise attempting to cheat them. Therefore, providing instant answers was a good demonstration of their goodwill and usefulness; new clients whose questions were escalated often did not believe the CKW would indeed return in four days with their answer.

Another major criticism was Question Box's inability to address health questions, as noted. This limitation is less easily addressed, and for the duration of the pilot, this was handled by directing callers to see a health professional, and to use the Google health SMS number for basic information as well as to locate a nearby clinic and its contact information. SMS and recorded voice services can provide health information with reduced liability concerns when an automated system provides verbatim answers rather than filtering them through a (non-expert) human operator. Nevertheless, that the lack of health information came up as a repeated complaint indicates that CKWs' access to the Google SMS health query system was not perceived as a sufficient replacement for the flexibility and accessibility that AQB provided.

The CKWs also expressed mixed feelings on their clients' potential willingness to pay for access to AQB. Some, particularly those whose clients had been helped greatly by the service, said that people in their district would be willing to spend their own airtime to call the service. Others felt that their clients only used the service because it was novel and free, and would abandon it as soon as they were required to pay for it. In general, there was a consensus that only livelihood-oriented information would be valuable enough to be worth the cost of airtime; the CKWs assumed that the questions of pure curiosity would decline substantially were the service paid for by its users.

VI. CONCLUSION

AppLab Question Box, therefore, represents a novel, if simple approach to provision of information to the rural poor in a setting like Uganda. It is well suited to settings in which mobile phone ownership and use is widespread. The pilot clearly demonstrated the considerable demand for livelihood-oriented knowledge, particularly agricultural. Moreover, the project's pilot, free of cost to its users, promoted wider use to indulge curiosity on a wide variety of topics. This window into both necessity- and curiosity-driven questions, combined with the needs assessment that preceded the Community Knowledge Worker initiative with which it was paired, is an excellent opportunity to examine the information needs and demands of these communities, including some not met by it or existing services, such as a flexible, expert-driven health information source. This demand is quite strong despite some initial difficulty in communicating the concept of an information service as such to its (clearly enthusiastic) users.

The project's deployment alongside similar services based upon SMS technology also shows the relative strengths and weaknesses of the two approaches. Question Box provided a much more user-friendly, flexible interface, albeit at much higher cost, making it appropriate for answering queries too complex or specialized to be answered by an automated system. Furthermore, it does not require literacy or technical phone skills beyond dialing a number.

Finally, the live voice setup, while labor-intensive, has relatively low technological requirements, and is able to function, at its most basic level, with only a computer, database, and phone line, although it is rendered much more powerful with the addition of an Internet connection and the

ability to forward questions to experts. This simplicity also lends it to short-term deployments as well as integration with other media.

It is this simplicity, accessibility, and broad applicability that renders Question Box such a powerful tool for improving information access to the rural poor.

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