# Mobile Phones and Voice-Based Educational Services in Rural India: Project RuralVoice

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**Abstract.** Voice-based services offer major business opportunities in developing areas such as India and Africa. In these areas mobile phones have become very popular, and their usage is increasing all the time. In this project, we study the deployment of voice-based mobile educational services for developing countries. Our study is based on a Spoken Web technology developed by IBM Research Labs, and our focus is on India's Bottom of the Pyramid (BoP). It is being built as a service that runs on the telecom infrastructure similar to World Wide Web that runs as a service on the Internet infrastructure. Spoken Web proposes to build an alternate web for the underprivileged population that is yet untouched by the enormous benefits of Internet and World Wide Web. In this research project RuralVoice we also investigate how Finnish service and technology companies can co-create novel services for this challenging target population in three educational areas i.e. agriculture, healthcare and entrepreneurship education.

**Keywords**. Bottom of the Pyramid, Mobile Education, Professional Education, India, Illiteracy

## 1 Introduction: Indian BoP Market for Mobile Services

A large market opportunity exists for businesses to tap at the bottom of the pyramid (BoP) in India [11]. This market segment is mostly in rural India, which is difficult to reach compared to urban India. The total population of India is 1.21 billion with a break up of 833 million from rural India and 377 million from urban India. This indicates a huge 69% to 31% rural to urban skew. Accessibility to this large rural BoP market is a huge challenge especially for services. The distribution channels for products have been established with large investments by some of the large consumer product companies but services have been a hitherto more or less unexplored category for this market.

The poor are vulnerable by virtue of lack of education, lack of information, and economic, cultural, and social deprivations [5]. Accessibility to this large rural bottom of the pyramid market is a huge challenge especially for services. The distribution

channels for products have been established with large investments by some of the large consumer product companies but services have been a hitherto more or less unexplored category for this market. A notable exception to this service drought in rural India has been telecommunication services.

Mobile phone penetration in India, in general, and rural India, in particular, has been growing at a breakneck pace. According to TRAI's (Telecom Regulatory Authority of India) latest Telecom Subscription Data as 3rd May 2012, the total number of mobile phone connections in India is 919.17 million with 595.90 million connections in urban India and 323.27 million connections in rural India. This higher share of urban subscribers at 64.83% as compared to the lower share of rural subscribers at 35.17% is because mobile connectivity was originally rolled out exclusively in urban centers as that was where the purchasing power existed for the then expensive service. As the service prices have dropped drastically the market in rural India has now opened up and that is where the growth is much higher than that in urban India. Every month 8 million new mobile connections are added across India at a monthly growth rate of 0.88%.

This is made up of 1.79 million new connections in urban India at a monthly growth rate of 0.30% and 6.02 million new connections in rural India at a monthly growth rate of 1.96%. It is expected that by 2013, the number of mobile phone subscribers will be 1 billion. The national mobile connection teledensity is 76.00 with an urban teledensity of 162.82 and a rural teledensity of 38.33. It is should be noted that more subscribers are coming from rural areas. What appears to be a comparatively low rural teledensity for mobile connections is very misleading in terms of a measure of the power of the mobile phone for accessing the rural market. This is because in rural India the mobile phone is not a personal device like in urban India but a shared device across the entire family. This makes the addressable market size using mobile phones larger than that suggested by the teledensity figures.

## 2 Voice-based services for BoP markets

Typically value added services through mobile phones have been delivered through text and web platforms. Both of these require the service consumer to be literate. Whereas literacy is a given in developed markers for mobile value added services, it is not the necessarily the case in the rural India bottom of the pyramid market segment. The illiteracy rate in India is 26%, with 31% illiteracy in rural India and 15% illiteracy in urban India. This problem is likely to persist, since elementary education is not targeted to adults, and children's drop-out rates are high. Illiteracy makes text base and web based service delivery platforms unusable. This creates a need for services that can be delivered on a voice platform instead of text or web. Currently, spoken services are used successfully in many areas in many countries. Typical examples of speech applications include transport information services, such as automated train and bus timetable services. The current trend is that DTMF (touch-tone) inputs are replaced by speech inputs. This may promote both greater user satisfaction and cost savings in some application areas In addition to IVR applications, many other forms of telephony applications have dominated the field. To address these challenges, IBM Research Labs have developed the Spoken Web to

deliver data and information to illiterate people. In a nutshell, Spoken Web content is stored in the form of voice-sites instead of text based web-sites. The content is in local dialects, making it much easier for illiterate people to access this information. It has been observed that IT systems with a voice-based feedback have much more appeal for the illiterate and semiliterate population of these regions [8][9] as compared to GUI-based systems such as Internet Kiosks. Voice-links allow for navigation between voice-sites using voice commands from a limited permissible vocabulary set. The interconnection of voice-sites leads to a WWTF or World Wide Telecom Web on the lines of the traditional World Wide Web. The lack of internet access limits access to the World Wide Web. Voice-sites can be accessed by dialing a phone number. The much higher access to mobile phone connections, therefore, makes access to voice sites much easier. In addition to fulfilling service needs for these BoP markets it also provides a platform to create and develop first in developing countries context and then "reverse" the innovation to developed countries [3] and probably building an institutional innovation system through creation nets [4].

## 3 Target Service Domains

According to Prahalad and Hart [11] the commercial infrastructure and ecosystem for BoP markets is driven by the following four drivers: creating buying power, shaping aspirations, improving access and tailoring local solutions (see Figure 1). The other drivers after this phase are reverting innovation back to developed countries [3] and building an institutional innovation system through creation nets [4].

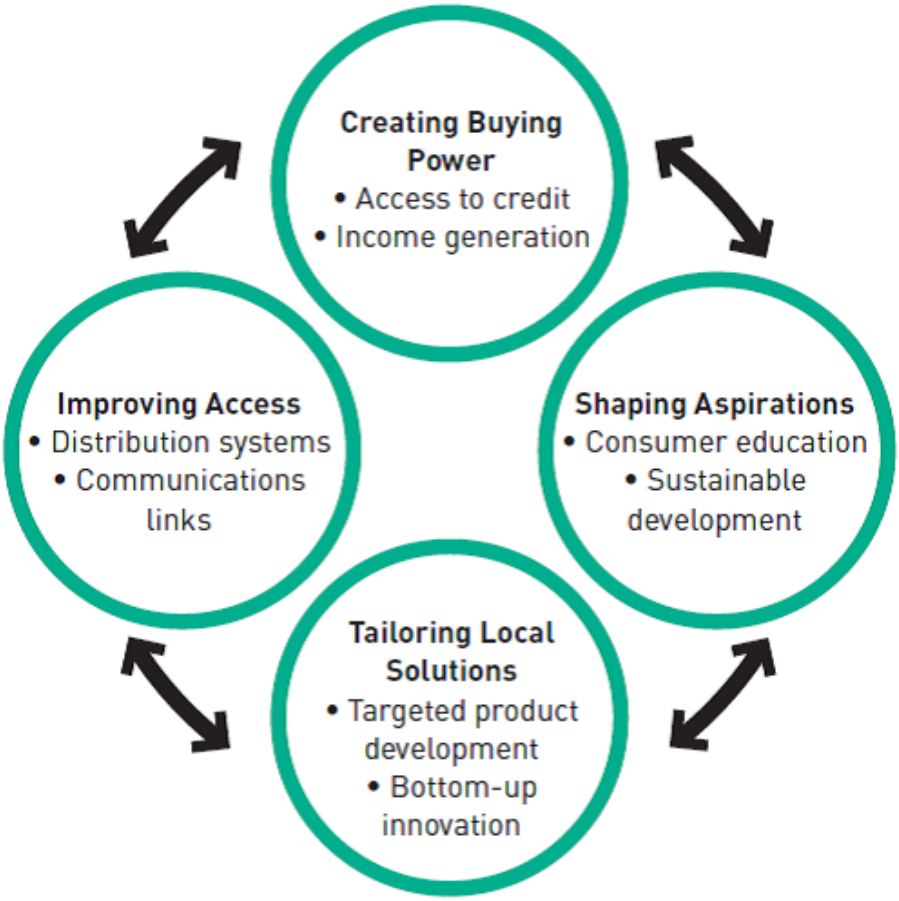


**Figure 1: The commercial infrastructure at the Bottom of the Pyramid [11].**

Based on our preliminary studies and strategic documents, we have identified the people at India's BoP markets require professional educational services and knowledge sharing in the following three urgent areas:

1. Agriculture education and knowledge sharing (local production)
2. Healthcare education and access to primary care (well-being)
3. Education for entrepreneurship and employment (economic growth)

Our work focuses initially on agriculture education provision. The existing work done in the area allows us a rapid start, and in particular concrete field studies can be conducted already in the initial phases of the project. Furthermore, the potential of other domains will be studied so that the results from studies on agriculture knowledge sharing can be applied to these fields as well.

In the area of agriculture, the problem is that of information asymmetry where people at the BoP do not have access to information on agri-commodity prices, weather, seeds, pesticides, fertilizers, and agricultural equipment. They need real time information access as and when required. Examples of information needed include agri-commodity prices, weather, seeds, pesticide, fertilizer, and agricultural equipment. There are three phases in agriculture i.e., production, processing and marketing of the crops. Farmers are in need of education and consultation for their problems during all these phases. So, this need based information is very vital for the farmers.

For primary healthcare education, the condition of health care in the BoP is very poor. Doctors are not present and access to any kind of modern health care is virtually non-existent. People in many villages have no option but to go to village quack and often face life threatening consequences. General knowledge on dealing with potential disease symptoms is limited. These people need genuine medical advice and access to consultation facilities.

In the area of professional education, a key contributor to India's growth story in a globalized economy has been the English speaking skills of the educated population. The illiterate population, who also do not know spoken English, have missed out on the opportunities that knowledge of the English language provides. Even without having requisite literacy levels for other jobs, knowledge of spoken English opens up several employment avenues that currently do not exist for the rural BoP. The focus on inbound tourism opens up possibilities in the hospitality industry where spoken English becomes a boon. This includes jobs if drivers, hotel housekeeping staff, tour guides, etc. In addition, knowledge of spoken English also opens up doors for employment for these people in urban centers for cleaning staff and errand runner jobs in MNC offices as well as expatriate managers' residences. These people in the rural BoP would like access to spoken English courses that do not need basic literacy as a prerequisite. In addition to English language education, there is a need for entrepreneurial education to grow their microenterprises and increase employability which supports the opportunities of poor people and growth of small businesses in rural India.

## 4 Farmer's Voice case study

The baseline Spoken Web technology is currently ready to be deployed commercially. Next, we present case studies carried out by its developers and the project team. Farmer's Voice [1][2] is Kannada language voice site created for the purpose of field study. Kannada is one of the official and classical languages in India. This is field study was carried out in close collaboration with University of Agricultural Sciences (UAS) Dharwad, IBM Research Lab, India and University of Tampere (UTA).

The Department of Extension, UAS works to transform the best agricultural practices, research work and agricultural technologies created by its staff to the farming community. In order to accomplish this goal, they have adopted several modern communication media such as Television, Krishi (Farming) Community Radio Station. Even though adopting all new mediums for communication, they are still not reaching entire farming community. In recent times most of the farmers in

Rural India owns mobile phones. Thus now the University is willing to propagate services through mobile phone medium. Their objective is to find ways to propagate agricultural information services through mobile phones using spoken web as a platform. This was prime research question of our field study.

In order to attain user experience and feedback about Raitarinda Raitara Dhwani – voice site application, we decided to interview participants from different age group i.e., from age group 20-30, 30-40 and above 40. We carried out two field studies, in the first we interviewed 16 participants and second field study we interviewed 35 participants. There were total 51 participants in the field studies, out of them 16 are female participants and remaining 35 were male participants. Most of the participants are illiterate or having very little formal school education. The content of this voice site is provided by the Krishi (Farming) Community Radio Station. The content is in local Kannada language, spoken throughout Karnataka state. There were total five sections in the voice site, like Krishi Chintana (Farming Information), Pakshika Salahegalu – (Tips to the farmers), Weather forecast, Market Forecast and Varada Basanna(Talk by veterinary doctor in colloquial Kannada language).

There were two prototypes of this voicesite, one is with background music and another one without background music. We went to total 5 villages near by University of Agricultural Sciences. The prototype was installed on mobile phone (Nokia C6 touch screen phone). The field study process included following steps

1. Voice site introduction
2. Demographics information – Noted participants demographics
3. Requested participants to use the prototype
4. Took participant's feedback

**Findings:**

- All the participants liked this initiative and service.
- Most of the farmers liked service with music, upon asking why they liked service with music, they replied "The background music helps them to concentrate and understand content clearly".
- Some of the Illiterate participants did not notice the background music.
- All the participants understood the content in the service very clearly. They said "As this information is in our local Dharwad rural accent, so we understood clearly".
- Most of the participants had their own mobile phones, thus they were very familiar with using mobile phones.
- For those who did not have mobile phones, they have used the mobile phones owned by their family members. These participants were also comfortable while using our prototype.
- For the illiterate users, initial guidance was needed, as some of them didn't knew few symbols like '#' and' *'. But after initial guidance and introduction, these participants were comfortable in using this prototype.

- Most of the participants said they would be happy to use this service without any subscription charges. Some of the participant said they are willing to pay small subscription charges if the service is very helpful for them.

**Suggestions:**

- Spoken medium is very powerful in rural India. From our field study, it is clear that, even though the some of the participants did not have formal schooling, they are very comfortable and very quickly able to use this service.
- However it is very important to keep the content in local dialect, when you are designing information services for the rural India.
- When developing business models it is very important that most of the rural users are from economically poor background. Most of them are unable to pay large subscription charges.

## • Previous other case studies on using speech-based technology

In addition to the mentioned research collaborative study, IBM has carried out a number of successful cases in using the Spoken Web technology:

**Avaaj Otalo** Avaaj Otalo [7] is a VoiceSite in Gujarati language providing an application for farmers to access agri-information over the phone. It allows farmers to access latest information regarding farming practices; it enables them to interact with agriculture experts by posting their questions on the VoiceSite. These questions may also be answered by other farmers, encouraging more peer interaction and community building.

**VoiAvatar** VoiAvatar [7] system enables individuals to create their own personal/business oriented VoiceSites. Each of these VoiceSites acts as an online avatar or proxy of those individuals. A VoiAvatar VoiceSite for a small business owner (such as plumbers, electricians, carpenters or craftsmen) could include information such as area of operation, service charges and work hours.

**Folksomaps** Sparsely populated semi-urban and vast rural areas of developing countries such as India do not have detailed map systems built for most locations. The semi-literate, low income, non-IT savvy population residing in these areas cannot use such services even if they were offered online over the internet. Secondly, lack of structured addressing conventions and poor road signs makes it difficult to follow the maps. So, even people comfortable with maps, often need to ask people on the streets to find their way. Folksomaps [6] is a community driven map system offered as a VoiceSite and a website that leverages Semantic Web technologies to create and manage a community generated knowledge base and makes use of web and voice applications to provide access to its services.

**Applications for Visually Impaired** Websites in the Web are primarily meant for visual consumption. Accessibility tools such as screen readers that render the visual content in audio format enable the visually impaired to access information on the websites but they have their own limitations. Since the access to VoiceSites is a simple phone call, it can become a pervasive and low cost IT access mechanism for the blind [12]. Surveys were conducted at two institutions for the institutions of blind in New Delhi which indicate that the learning curve for using applications on the Spoken Web is relatively low and does not require extensive training.

University of Tampere (UTA) has worked with spoken and multimodal mobile services for more than ten years[13] [14]. Its existing research prototypes include numerous applications which have been piloted in large-scale pilots with real users in Finland. For example, the publicly available TravelMate application offers spoken and multimodal public transport guidance for mobile users, and the MobiDic application was developed for mobile dictation and notetaking needs. Currently, UTA is developing spoken mobile applications for medicine and healthcare. Another recent work includes speech and symbol based tablet applications for illiterate people. In these applications (and many others), UTA has applied the technology for special user groups, such as visually-impaired people, who share many issues with illiterate people. Most importantly, the work done with these systems completes the work of IBM Spoken Web in many ways. First UTA is the one the key players in world in the area of spoken mobile applications, and is thus in an excellent position for helping to deploy the Spoken Web technology with IBM and Finnish SMEs. Second, UTA has developed multimodal technologies which can be applied for future applications of Spoken Web and tablets. In particular, UTA and IBM have planned to apply novel auditory, haptic, gestural and symbol based technologies for Spoken Web.

## • Conclusion

In the preliminary studies, we have identified that India's BoP people require educational and knowledge sharing services in the following three large areas: agriculture, primary healthcare, and entrepreneurial education. The baseline Spoken Web technology is currently ready to be deployed commercially. In this paper we presented case studies carried out by its developers and the project team. We also show how the spoken technology development carried out can make advanced multimodal Spoken Web services possible. Proposed results of the research and development project are i) viable business models to deploy voice based services for the Indian BoP market, ii) improved multimodal Spoken Web technology, iii) several deployed Spoken Web services and iv) several documented field studies conducted in India. We will work in close collaboration of the network partners to apply the results into real world services. In this way, the results of this project make also commercial products possible in the company driven actions which run after and in parallel with the proposed base project. In addition to the Indian BoP market, the results of the project can be applied for similar market areas, such as African countries, with similar processes.

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