Use of Mobile Technologies for Empowering Small holder farmers in India

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Abstract

Key words: Small holder, mobile technologies

Smallholder agriculture dominates the landscape of the developing world. Increasing their productivity and incomes can make a major contribution to reducing hunger and poverty. The average size of land holdings in India fell from 2.3 ha to 1.06 ha between 1970 and 2002, implying that the number of smallholders is growing – 86% of the land holdings are now less than 2 ha and the average operated land area is around 0.4 ha for this group . The factors include rural population growth, inheritance practices, and unfriendly land leasing systems. They contribute around 70% to the total production of vegetables, 55% to fruits against their share of 44% in land area . Their share in cereal production is 52% and 69% in milk production. Access to technological information is one of the most important enablers for smallholders to improve productivity sustainably. A pilot study on use of mobile technologies for providing information and advise on agriculture to small holder farmers across the country has indicated flow of variety of messages reducing the cost and availability of information at right time. A platform of technology, subject matter and ground level institutions have been created with an architecture for content development and its delivery as per location specific requirements.

Smallholder agriculture dominates the landscape of the developing world. Increasing their productivity and incomes can make a major contribution to reducing hunger and poverty (Zhou, 2010). Indian agriculture is the home of small and marginal farmers (80%). Therefore, the future of sustainable agriculture growth and food security in India depends on the performance of small and marginal farmers. The average size of land holdings in India fell from 2.3 ha to 1.06 ha between 1970 and 2002, implying that the number of smallholders is growing – 86% of the land holdings are now less than 2 ha and the average operated land area is around 0.4 ha for this group (NSSO, 2006). Many factors contributed to this trend. They include rural population growth, inheritance practices, and unfriendly land leasing systems. Most importantly, there is a lack of off-farm employment opportunities for smallholders, who typically have limited education and professional skills. In terms of production, small and marginal farmers also make larger contribution to the production of high value crops. They contribute around 70% to the total production of vegetables, 55% to fruits against their share of 44% in land area (Birthal, 2007). Their share in cereal production is 52% and 69% in milk production. The results of NSSO 2003 Farmers' survey has empirically established that small farms continue to produce more in value terms per hectare than the medium and large farms. It is true that small holdings have higher productivity than medium and large farms. But, it is not enough to compensate for the disadvantage of the small area of holdings.

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The cost of cultivation per hectare is high on small and marginal farms than medium and large farms (Dev, 2012). Access to technology is one of the most important enablers for smallholders to improve productivity sustainably. Innovative mechanisms for technology transfer are required to bring relevant tools, knowledge and knowhow to farmers. Market linkages are common weak points between the smallholders and formal supply chains. Intermediaries are required not only to aggregate production from small-scale growers, but also to provide support and services to ensure the quality and consistency of production. ICT applications can foster dissemination of information on technology, market demand and price information; weather, pest, and risk-management information, best practices to meet quality and certification standards.

The policy framework for agricultural extension (Ministry of Agriculture, Government of India, 2000) highlights the opportunity for information and communication technology (ICT) to improve the quality and accelerate the transfer and exchange of information to farmers, and ICT is consequently given a high priority, particularly as a tool for improving the marketing aspects of farm enterprises.

Indian telecommunication revolution that too wireless connectivity made it possible to reach to unreachable located consumers through mServices. During the present decade, India has seen an exponential growth in the telecom particularly in wireless. Rural teledensity has just reached the two digit level whereas the urban teledensity is moving towards the three digit level. Mobile- penetrations among the 700 million rural population are put at about 16-18 percent and growing rapidly (TRAI, 2009). The penetration is at least 10 million subscribers every month from September 2008 onwards. Even the masses have access to mobile connectivity, but the potential of the handsets are not yet tapped. This is largely because of the content delivered is often not directly related to their livelihood and environment. Since they need localised news and information directly delivered in their language to meet their daily needs. Out of 593731 inhabited villages, the service providers had reported that 407112 villages have already been provided with mobile coverage (TRAI-1, 2008).

About 57271 villages in the country are yet to be connected with mobile services. The Government has plans to cover all villages by March, 2013 (Department of Telecommunications, Government of India, 2012)

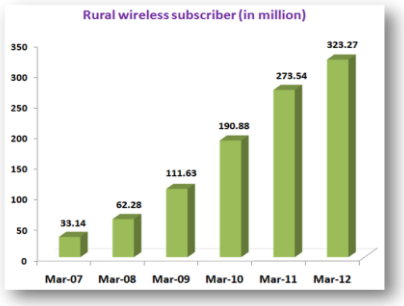
Table 1: Telecom subscriber growth

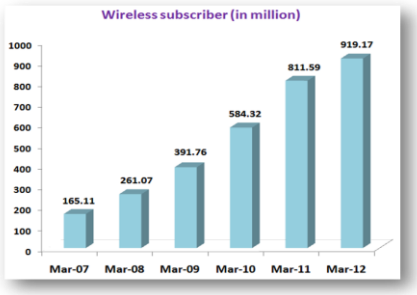
	2006	**2007**	**2008**	**2009**	**2010**	**2011**
Total population (in millions)	1152	1169	1186	1203	1220	1237
Mobile subscribers (in '000)	149,620	233,629	306,533	370,002	419,360	459,828
Mobile penetration (in %)	13	20	26	31	34	37

Source : Telephone Regulatory Authority of India – 2006-2011

Mobile based applications and services for rural India

With quality information at rural people fingertips, and appropriate mServices available in local languages, rural people can make improved decisions, specific to each individual. Still expanding their vast reach and simplicity of use at affordable cost, mobile devices are now in a position to extend public services to rural people at corner of the country. As a result, there is a growing focus on m-based services implementation by public and private bodies ready to disseminate information as per the needs of the rural people.





Source : Telephone Regulatory Authority of India - 2012

The solution for reach, affordability, acceptability, personalised with privacy got ascertained. There are challenges – affordability is a key issue for many potential users. Not everyone can afford handsets; innovative business models adopted by the firms and handsets at low price tag which work for voice and sms based services. Looking at flexible business model rather than complex and rigid one of the past is need of the day. The thing still missing is the confidence on the system, delivery mechanism through affordable mobile unit, localised content in local language, easy to understand (NSNRS, 2008).

Need of Mobile ICT intervention for Agriculture

To bridge the information gap between the farmers and to build productive and competitive market, different ICT interventions support rural and under-developed markets to become efficient and productive. Agriculture extension and farmer-outreach programmes are facing major challenges (Ramamritham, 2006) – cost-effective outreach, solutions tailored to needs of individual farmers and an image that is farmer-friendly. The mobile technologies have created new channels to communicate with others. Farming is not so linear but requires constant inputs at every stage where new technological inputs provide better crop outputs. It means, crop production depends on weather, agricultural practices and management of pests and diseases at right time to save crops and gain better results. The final produce should provide better marketable price to farmers, where the market intelligence is the key, which provides regular information about nearby markets in local language.

Mobile based projects' in rural India

The mobile phone technology provides the electronic capabilities (battery, processing power, memory), reach to customer, provides privacy, anytime and anywhere, contact-less services and most preferred user carry personal item (Helen Nierinck, 2008). Keeping these factors and the needs of Indian farmers in mind, various applications and services have been deployed by different projects. The projects are providing farmer needs' based mServices through their technological innovative applications combined with creative business plans – aAqua mini (Bahuman and Kirthi, 2007), Fisher Friend (Thomas, 2007), mKrishi (Robert Horvath, 2008), Reuters Market Light (RML) (Amit Mehra, 2007), IFFCO Kisan Sanchar (Awasthi, 2008), Life Tools (NSNRS, 2008) and CERES (Anurag at el, 2008). The mobile based projects for farmers had objectives which benefit farmers, based on development agenda. These objectives have orientation for markets (input, output) prices, availability status, agricultural extension, social connectivity and finally financial support systems.

The basic core needs and demands of the end-users are mServices at affordable cost creating confidence on users. The applications used in the services are of short message service (SMS), multi-media service (MMS) and voice stream options. These are customised based on

subjectivity such as literacy, usage pattern, social acceptance, domain specific and life-style of rural farmers in various states. Most of the initiatives are push-based method providing opportunity to fill the knowledge transfer to end users' basic needs.

Table: Indian pilot projects in Agriculture domain

S. No.	Project Name	Partners (with service option)
1.	**aAqua Mini**	Agrocom (on GSM,CDMA)
2.	**mKrishi**	TCS-Qualcomm (on GSM)
3.	**Fisher Friend**	TATA Tele-Qualcomm-MS Swaminathan Foundation+ Astute Systems Technologies (CDMA)
4.	**Reuters Market Light** (RML)	Reuter-MSAMB-India Post (on GSM, CDMA)
5.	**IFFCO Kisan Sanchar** (IKSL)	IFFCO-Airtel (on GSM)
6.	**Life Tools**	Nokia+ Idea+ RML (on GSM)
7.	**CERES**	CERES+ Reliance (on CDMA)
8.	**KISSAN Kerala**	PAN India based service
9.	**Sanchar Shakti**	Universal Service Obligation Fund of Telecommunication Department

The projects become a source of knowledge and information transfer for farmers from agriculture scientists/extension functionaries and markets through mobiles. The critical thing here is the understanding of requisite content or knowledge for farmers' needs. Providing local content in local language through text mode, the literacy challenged farmer is facing the real hurdle to utilise the opportunity for his/her benefit.

i. aAqua Mini – It offers real-time decision-support tools (aAQUA) to progressive farmers and organizations supporting progressive farming (Bahuman and Kirthi, 2007). The project envisaged working on revenue generating business model. The services provided are broadly to farmers include, localised – remote crop diagnostic solution; audio prompted guide application (in English/Marathi/Hindi); remote crop & land properties based disease diagnostics; micro-weather info (temp, cloud cover, precipitation); SMS enabled register and query mechanism; online poll for registered users; spam, search, rank features; and service is available on GSM and CDMA networks. The aAQUA eAgriService is a problem-solving system dedicated to find solutions to problems posed by Indian farmers - small and large. Answers to agri-related queries are sent in 24 to 72 hours depending on the difficulty. 60 Experts form the expert forum who come from diverse areas of expertise.

ii. Fisher friend – The Fisher Friend project of the M.S. Swaminathan Research Foundation (MSSRF) in Tamil Nadu and Puducherry leverages mobile technology to provide vital livelihood information to fisher folk.

MSSRF partnered with Qualcomm, Tata Teleservices and Astute Technology Systems for developing the Fisher Friend Mobile Application. The tool was designed after a thorough needs assessment of the fisher communities and incorporation of feedback from central stakeholders. Upon sending a single-button-click request from an icon-based software

module on mobile, fishermen gain access to vital updates on wave height, wind speed and direction, potential fishing zones, news, government schemes and market prices. All content is displayed in the local language - Tamil.

iii. mKrishi – Tata Consultancy Services' (TCS) Mobile Agro Advisory System (mKRISHI) connects farmers with an ecosystem that empowers them to make efficient decisions about agriculture, drive profits, and conserve the environment. This allows the farmer to make a query in a local language from a mobile phone and receive personalised advice or relevant information on the same in local language (Robert Horvath, 2008). This is the project working on private partnership based revenue generating business model in Maharashtra and Uttar Pradesh states at present. It is testing to test its sustainability with Indian farmers' needs. The services provided are broadly to farmers include, crop disease diagnosis; sensors based remote land & crop property recording (grape, cotton, soybean and potato); micro-weather Information (temp, cloud cover, precipitation) and service is available on CDMA networks only, but not on GSM networks.

iv. Reuters Market Light (RML) – It offers Indian farmers up-to-date, local and customised commodity pricing information, news and weather updates (Amit Mehra, 2007). The project is working on public private partnership (PPP) revenue generating business model in Maharashtra and Punjab states. The broad services provided to farmers include, localised - commodity pricing (Onion, Cotton, Soybean, Pulses, Pomegranate et al); weather updates; news (agriculture & general) and service is available on GSM networks only, but not on CDMA networks. Reuters Market Light is a pioneering mobile phone-based highly-personalised professional information service specially designed to support the farmer community.

RML was launched in India in the state of Maharashtra in October 2007 and in October 2008 in the state of Punjab. Today RML operates in 13 states in India and covers over 250 crops and more than 1000 markets and 2800 weather locations across these states.

v. IFFCO Kisan Sanchar (IKSL)- The idea is to make use of IFFCO's (Indian Farmer Fertiliser Co-operative) deep extensive reach and establish a low cost telecom distribution channel through the network of cooperative societies. To accomplish the task, IFFCO tied up with Airtel to build and offer a platform for the farmers through the cooperative society network. The unique venture provides the farmer the much desired inputs on real time basis which is going to help him on agri-related issues and would guide him for his day to day chores. The project is working on public-private-NGO partnership based revenue generating business model across major states covering in two stages. The services to farmers include, telecom products and services of Airtel; free daily voice updates on VAS platform (mandi prices, farming techniques, weather forecasts and fertilizer availability) and dedicated helpline for farmers to answer their queries

vi. Life Tools – It is having a range of agriculture, education and entertainment services designed especially for the consumers in small towns and rural areas of the emerging markets (Nokia report: 2008). This project works on private partnership (PP) based revenue generating business model in India. The services include, information on seeds, fertilizers, pesticides, weather (temperature, rainfall, wind conditions) and prices in English, Marathi and Hindi language option and prevailing market prices, education service in dual language display option.

vii. CERES – It aims to assist farmers by providing exhaustive information covering all areas

in timely and customized manner to meet specific local needs to increase the overall productivity of agricultural practices (Anurag et al, 2008). This is the project working on private partnership based revenue generating business model in Gujarat state covering 78 villages in Vadodara district. The services provided specific to farmers include, information on seeds, fertilizers, pesticides, disease and farming input; market prices and weather (micro-climatic, rain/storms, temperature, humidity, precipitation, wind speed) on weekly and monthly basis.

viii. KISSAN Kerala – It is an integrated, multi-modal Agricultural information system, which provides several dynamic and useful information and advisory services for the farming community across the state of Kerala. The core deliverable and achievements of the project is an integrated multi-component, multi-modal delivery of Agriculture Information Services system that is accessible anywhere anytime by all concerned. The project adopted a strategy of providing right information to the right people in the right context and empowers the farmers with adequate knowledge, which helps them to take better decision. The project solves the problem of content gaps by providing the authentic agricultural information though various delivery methods like Television, Internet, Telephone, and Mobile. The farmers may choose any medium to seek the relevant information. The project offers the following major services through the effective integration of ICT systems and tools to reaching out to the farming community.

(A) Online Agri advisory service: The dynamic, multi-lingual portal based online Advisory services for the farmers (www.kissankerala.net) provides several interactive contents and dynamic advisory services for the farmers. The farmers can seek the advisory from the expert scientists through online and get better scientific advisory for their problems

(B) Kissan Krishideepam : It deals with production and telecast of Agriculture based weekly Television programme - in local language through Satellite channel

(C) Online Agri video Channel: The project has launched the country's first online video channel in Agriculture in collaboration with Google/YouTube with more than 150 telecast quality videos

(D) Tele Advisory Services: The project also provides telephone based Agri advisory services through a dedicated telephone number to provide real-time information and advisory; A dedicated telephone connection has been established and backed up by Agricultural scientists

(E) The mobile based Agri Advisory services: The project offers text, voice and video content based Agri information services through mobile phones. : A dedicated PAN India based mobile based service has been established to provide text, voice and video based information services. It offers several services like crop advisory, weather forecast, soil test information etc through farmers mobile.

ix. Sanchar Shakti

This scheme has been initiated by the Universal Service Obligation Fund (USOF) of Department of Telecommunications (DoT), Ministry of Communications & IT to contribute in the empowerment of rural women. "Sanchar Shakti" is a programme of pilot projects aimed at facilitating SHGs' access to ICT enabled services and their contribution towards ICT enabling services. There are 4 categories of projects under this scheme:

i. The provision of subsidized mobile VAS (mVAS) subscriptions to SHGs which are valid for at least a year.

ii. The setting up of SHG run mobile repair centers in rural areas.

iii. The setting up of SHG run modem repair centers in rural areas.

iv. The setting up of SHG run solar based mobile phone/ Fixed Wireless Terminals (phones) charging centres in rural areas.

It is widely accepted that access to Information and Communication Technology (ICT) can play a crucial role in the development to rural and remote areas and the people residing in such places. This programme envisages using ICT to facilitate the process of empowerment of rural women through delivery of information and skill enhancement.

X. agropedia –ICAR initiative

Content availability and its intelligent organization continues to be a serious challenge in agriculture. This prevents offer of meaningful and efficient advisory and allied services to farmers and other stakeholders. **agropedia** is an attempt to infuse semantic and social networking technologies into agriculture information management to alleviate this problem. In its short span, it has developed several path breaking concepts and demonstrated their feasibility:

- Crop knowledge models(KMs) – which are network representations of agriculture knowledge
- Use of KMs for tagging content and people; useful for searching information and locating people with similar interest
- content management platform – for storing and searching everything in agriculture
- agropedia deployment options – appliances for off-line/on-line access where the connectivity is poor
- Social networking platform – like wikis, blogs, chat rooms for interconnecting agriculture community.

agropedia also managed to attract human resources from FAO and could connect and link up with several National and International organizations. About 500 mid and senior level experts in the SAU-ICAR (State Agricultural University-Indian Council of Agricultural Research) system have participated in a number of capacity-building programs on agropedia and have contributed to content and KM's.

The agropedia platform stands today as a model of content organisation, its core strengths being semantic web techniques and the methodology to build (and link) knowledge models for crop science and farming systems. These elements have combined to make agropedia a pioneering ICT enabler for agriculture in India. The addition of social networking technologies and openagri, a knowledge repository, has added depth to agropedia's capabilities.

Total 631 Krishi Vigyan Kendras-KVKs (Agriculture Science Centres) have been established across the country at district level with a team of multidisciplinary team of experts. The KVKs aim at technology assessment and refinement and work as knowledge and resource centre in the district. However, with a purpose of extending their reach to large number of farmers on real time basis, some experimentations on mobile applications have been worked out in collaboration with technology and subject matter institutions to create an architecture of content management and its delivery in the form of text and voice messages using mobile phones.

vKVK : Voice Krishi Vigyan Kendra

A voice KVK (vKVK) is a set of advisors (KVK experts) and peers (lead smallholder farmers) connected through mobile and internet technologies. In the vKVK, the interaction between the two parties can be entirely electronic. The agropedia platform acts as 'middle ware' for this interaction providing amplification (one-to-many and many-to-one), persistence (messages are stored and can be searched, retrieved), monitoring and other utilities which are possible when the content is electronically stored and semantically indexed. Sub-systems are developed to address the needs of vKVK scientists, farmers and the middle ware to deliver advisory services, alerts and Q&A services over SMS, voice and Web. Mainly E to F (Expert to Farmer), F to E (Farmer to Expert) and E to E (Expert to Expert) services have been tested and operationalized in voice mode.

Conclusion: There have been experiments in technology dissemination using ICT but the mobile applications recently started can revolutionalize the information reach to the resource poor small farmers on real time basis. The content development for different clientele groups in different languages is a challenge but voice messages give an easy option for delivery and its understanding by users in case of most of the handsets. Text messages in different languages may be a limitation on some of the handsets. The cost of voice messages are higher which may be brought down with technology development. The development of appropriate software, content development and its authentication and farmer friendliness, reducing cost of message delivery and involvement of different players may bring an environment of efficient use of mobile services. Timely and actionable information from trusted sources, locally relevant, storable and reference able and access of experts may enhance the effectiveness of mobile services. Video calling facility may further enhance the quality of communication.

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