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Mobile Applications for Indian Agriculture Sector: A case study

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Abstract

Government, private agencies and the general public are often interested in the decisions made by the Indian farmers as they have large influences beyond the farm boundary. Over many years, the process of adoption of new technologies and policies in the Indian agricultural sector has received considerable academic attention highlighting the role of many social, financial and other influences on their decision making. The Indian government and other development agencies promote income generating projects as a way of encouraging growth through increased agricultural production and the protection of the natural resource base. The impact of new technology to economic growth can only be realized when the use of these new technologies is widely diffused. In this paper the overview of agricultural mobile technologies and applications have been discussed and the challenges faced by the farmers to utilize them effectively. The advantages to farmers, traders and producers by introducing mobile applications and services in agriculture to improve decision making will also be examined. Two existing agricultural mobile application eMandi and Mandi Trades for trading of commodities will be described and evaluated.

Keywords: agriculture, mobile applications, farmers, decision making, eMandi, Mandi Trades

Introduction

Government, private agencies and the general public are often interested in the decisions made by the Indian farmers as they have large influences beyond the farm boundary. More than 200 million Indians are agricultural laborers as of 2013, (The Economic Times Indicator 2013). They alone contribute to more than 13.7 % of the GDP growth of India, (Report on Employment and Unemployment Survey 2010). Agriculture clearly remains one of the most important portfolios in developing the Indian nation's growth. The upliftment and improvement of rural livelihoods of these communities will lead to farmers being able to pursue some other profession, (Donner 2008, Kalba 2008 and McNamara 2009).

Over many years, the process of adoption of new technologies and policies in the Indian agricultural sector has received considerable academic attention highlighting the role of many social, financial and other influences on their decision making. For India, over the last decade, the markets in both developed and developing countries have been flooded by mobile phones, tablets, and other pervasive devices (Cranston 2009 and Cranston et al. 2010). The mobile phone has evolved in its form, functionality, affordability, compatibility and consistency in the underlying hardware and operating systems. Most of the mobile phones available are supported and loaded

with a variety of applications. The widespread use and affordability of mobile phones gives way to a lot of providers to introduce applications which add value through the meaningful information collected and presented from a variety of sources. These providers need to cater for users with both primitive and new generation interfaces. Mobile applications indeed have a widespread penetration worldwide in all sectors; and to a lesser extent in the agricultural sector, (Bhatnagar 2008, Mittal 2010 and Manimekalai 2013). These applications potentially deliver timely information to different subscribers such as farmers, traders and producers. The information delivered includes weather, rainfall, crop information at large, while some applications also help update the market data of commodity prices and facilitate the local buying / selling via hand held devices, (Woodill et al. 2012 and Shannon 2013). Depending on the availability of network 2G and 3G, the applications have helped the farming community at large to be connected, updated, prepared and profitable, (Vodafone 2010).

This paper examines the evolving mobile applications for the Indian farming community, the variety of salient features they offer, the challenges and shortcomings mitigated by the applications. Despite availability of such mobile technologies, some challenges still remain to be tackled. Further suggestions are made in this paper for the possible measures to help mitigate these challenges.

Adoption of Mobile Technologies

The ITU World Telecommunications / ICT Indicators database have published the growth of the mobile subscriptions during the first decade of the 21st century. The global mobile phone connections have grown at more than 10% each year from 2000 through 2010. The World Bank has also projected the comparison of the total number of mobile connections worldwide along with the total market penetration. The study shows that the market penetration stood at over 60 % with 5 billion connections during 2009 while it is projected to be crossing the 100% mark with 7 billion connections. The mobile phone connections have grown from 5 billion in 2009 to around 6 billion in 2014 and projected to grow at an even faster rate by 2015. With the growing infrastructure and increasing measures taken, the projections seem all the more realistic. Out of the connections, growing economies like India and China occupy a big chunk, obviously because of the increased amount of population and also because of the regulators supportive guidelines which promote the penetration to remote places also. India alone was at 880 million connections in 2013 while China was more than 1.2 billion, (Statista 2014). With the advent of smart phones in the last 5 years, the providers have seen a huge potential in developing applications on Apple, Android and Microsoft platforms and introducing them worldwide at attractive pricing models, (Rashid et al. 2009, Brugger 2011 and Payne et al. 2011).

For most developing nations the farming community which includes farmers, producers, traders and others directly or indirectly involved are not adequately educated. The use of ICT tools in agriculture sector for rural farmers while emerging as a potential for improving the livelihoods of farmers is still not been adopted fully by all farmers, (World Bank 2011). However, research has shown that they have keen interest in learning to operate and use technology which will enable them to take constructive and in time decisions about their farming (Aguero 2009, Armstrong et al. 2012a, Armstrong et al. 2012b). Hence, there is an immense opportunity to enhance the broadcasting of agricultural information that farmers receive through the use of Information and

Communication Technologies (ICT), (Leye 2009, Ballantyne et al. 2010, Armstrong et al. 2011, and Kirk et al. 2011). This has already been the case for farming communities in developed nations like Europe, America, Australia, New Zealand, South Africa, where farmers are well educated and farming practices reliant technologies and smart farming systems are used (Momagri 2012). The cost of manpower is more; hence the need of introducing technology and means to minimize the human intervention in farming activities is practiced. In such scenarios applications supporting advanced embedded systems are being deployed successfully which helps increase productivity as well. The mobile applications are indeed going to help the farmers in their activities to ensure they stay well balanced and focused, (Aker 2010).

One of the major reasons why the farmers have faced challenges is because they rarely received adequate and timely information on various influencing factors such as weather, rainfall and soil conditions (Chambers 1985, Ratnam et al. 2006, Cantor 2009 and Goyal 2010). Similarly, the majority of farmers do not have access to a communications platform that provides market trends and other current updates. Mobility has been suggested to have an important role in sustainable rural poverty reduction, (Silarszky 2008 and Muto 2009) which would indicate the huge potential of mobility to improve agricultural productivity.

Classification of Agricultural Mobile Applications

Agricultural mobile applications can be classified through the nature of information, the applications help provided, the usability of the information and the frequency of the use. For instance an application which provides the market price of commodities is much more volatile in nature and the information provided at one instance may be of less use when the demand versus supply fluctuation ends up influencing the market rates. The short term weather forecasts can help in planning alternative crops or apply hybrid methods.

The categorization of agricultural mobile applications categories with respect to the factors like availability, criticality, applicability and usability is is Table 1. Though each category of applications have its unique importance and existence, there are applications which tend to combine various categories to give it a holistic view and make it more marketable. Service category gives information on educating the farming community with farming fundamentals, information on factors influencing the crop growth, articles published, breakthroughs achieved locally and globally that can motivate, location specific collated information that provides aid for taking in time and profitable decisions. Interactive Markets category includes applications that provide various commodity prices from different locations in a collated format. The applications which enable trading systems and platforms to identify best sale/buy opportunities give an interactive edge and provide a tap on the portfolio and earnings. Support category makes provision for the process and information flowing through various processes. For example logistics update on goods tracking, governance updates / follow ups on approvals / tenders etc. It also helps to track finances like bank accounts / insurance renewals & claims / creditors & debtors, sales and purchase, invoices / inventory management. Repository category help provide regulatory updates on policies, surveys, research and other relevant information. Education category helps educate the farming community in many ways. It helps the farmers retrieve and read information on all categories like seeds, soil, moisture, pesticides, insects, diseases, rainfall, topographies, farming equipments and supporting machinery. Some existing mobile agricultural applications in each of the category described above and in Table 1 are provided in Table 2.

Table 1 Categorization of Agricultural Mobile Applications (adapted from Brugger 2011, Woodill et al. 2012 and Shannon 2013)

Category	Frequency	Usability / Applicability
Service	Push: timely/ frequency set by feed providers / can be made immediate as well Pull: On need basis	1. Weather broadcast 2. Rainfall broadcast 3. Need based articles 4. Government updates / mandates 5. Calculators on soil quality, waterfall, moisture etc which help in effective planning and decision making 6. Information broadcast on events like instruments, training either public which are government supported or company specific
Interactive Markets	Push : Immediate Pull: On need basis for market data	1. Market updates on falling / rising prices 2. Trading platforms
Support	Push : timely / frequency set by feed providers / can be made immediate as well Pull: On need basis	1. Accounting systems of Sale and Purchase 2. Logistics like Goods tracking and Inventory Management 3. Payments, Claims and Renewals
Repository	Push : on occurrence	1. Surveys / Electoral data 2. Policy changes / deadlines broadcast
Education	Push : On update availability Pull: Request for more info via suggestion boards in the application	1. Information on Insects, diseases, pesticides 2. Information on machinery, usage of machinery, comparison of different make and prices 3. Information on soil, seeds, moisture, regional based rainfall predictions 4. Case studies or real experiences with facility to add one of your own

Table 2 Examples of existing mobile agricultural applications in each of the category (adapted from Woodill et al. 2012 and Shannon 2013, NSEIT.com 2014)

Category	Application	Comments / Description
Services	Growing Degree Days	This application takes as input the days data based on a location and helps in deriving the maturity of a crop, (Woodill et al. 2012 and Shannon 2013).
	Genuity Seed Selector	It's an application that assists in selection of ideal seed depending on the type of the soil and the moisture, (Woodill et al. 2012).
Interactive Markets	eMandi	A sophisticated trading platform for commodities offered in India to agricultural traders and farmers. (NSEIT.com 2014)
	Farm Futures	Market watch for commodity and options detailed price movement, (Woodill et al. 2012 and Shannon 2013).
Support	PureSense Irrigation Manager	Control and monitor the field irrigation activity and conditions remotely, (Woodill et al. 2012).
	Dairy Inventory Form	It assists the farmers in checking the inventory of the dairy products and keep a check on the same, (Woodill et al. 2012)
Repository	Turfgrass Management	This application provides information on field pests in a varied manner that includes images and preventive measures, (Woodill et al. 2012).
	Agrian Mobile Information Center	A complete repository of products in the agrian DB with search filters on all major fields, (Woodill et al. 2012 and Shannon 2013).
Education	MySci Pubs	It publishes and provides information on various crops and crop sciences incorporated through various journals and other research articles, (Woodill et al. 2012).
	Agricultural Glossary	This application provides valuable information on all the agricultural terms with their meanings, (Woodill et al. 2012).

Advantages of Mobile Applications

The inevitable and growing importance of mobility in agriculture offers various advantages. All types of information on crop, soil, climate, rainfall, seeds, and machinery at any point in time, and any number of times is available on finger tips of farmers, (World Bank 2011). The information available is localized, thereby increasing the comfort and precision as required. This information is updated on regular basis and delivered via various means and modules of applications that the farmer need not worry about getting the information from other sources. The available information is compiled and very well organized that farmer does not have to waste time while retrieving and referring, (Kirk et al. 2011). The market connectivity is also improved with the visibility and knowledge of the potential buyers and sellers in the locality with an opportunity to develop direct contacts. The commodity prices can be delivered in a real time mode. Mobility can assist the farmers in better warehousing facility by updating their stock, track the dead stock, make note of the purchase requirements and thereby honoring the delivery commitments in a timely manner and getting the stock reach the end consumer and at the same time ensuring quality, (Kuek et al. 2011). Further this is beneficial in buying and selling of goods locally and

helping them to keep a track of their buy-sell requirement. The farmers can be well updated about their investments, track orders made on purchases, view bank statements, be well informed of insurance details and deadlines and thereby plan the production effectively, (Baumuller 2012).

Disadvantages of Mobile Applications

As much as mobility has its advantages there are some shortcomings as well. With the diversity in languages, even if the best of the applications do not support regional languages then translation will be required at all stages which will increase the dependency and in turn reduce the acceptability and popularity, (Cantor 2009). At times, due to network issues, speed of the data delivery, legal restrictions, it might prevent the farmers by getting the updated and complete information, (Kirk 2011). There may be a requirement of a skilled person to understand and translate the various complex functions to be performed on farm, ambiguous information and videos in other languages, (Baumuller 2012). The farmers in the developing nations may not be adequately equipped to afford and use the applications which may be chargeable and also require huge data usage thereby levying the network charges on the burdened shoulders of the farmer, (World Bank 2011).

Case Study

The section below describes two case studies of agricultural mobile applications which are available in Indian market. The applications chosen are eMandi and Mandi Trades. The first application offers a platform to support trading of commodities involving farmers, traders and other buyers. The second application offers the farmers to upload their agricultural produce online for sale. This can be viewed by potential buyers in the locality and can contact directly the buyers for the trade. Both the applications are online and offer mobile based solutions, also offer the prices of commodities to be seen on a real time basis and involve all stakeholders under one roof. An analysis and comparison of both these case studies is provided below.

eMandi

An online trading platform given to farming traders by NCDEX (National Commodity & Derivatives Exchange Limited), India, which is technically powered by NSE.IT (National Stock Exchange IT), is discussed (NSE.IT 2014). It is a sophisticated mobile and handheld device application that facilitates seamless online trading of commodities across the APMCs (Agricultural Produce Market Committee). It integrates all major APMCs across India with the major markets. This application provides transaction logging & seamless streaming of Markets data. It allows SMS based authenticated trading. It provides direct purchases by traders from farmers without commission agents. It also has stock and inventory tracking of each commission agents and trader's inventory. It is integrated with mobility solutions using SMS, Windows Mobile, Android and iOS. There are various salient features of e-Mandi application (Mrunal 2013 and eMandi 2014). It provides a transparent platform whereby the farmers can bring in their grain produce and sell directly with the help of traders. It helps deliver trading tips, performance reports via SMS on a daily basis. It works on all platforms i.e. SMS, Windows Mobile, Android and iOS. It has stock and inventory tracking mechanism inbuilt. It includes various stakeholders under one roof. This will help in reducing the time to market.

The initiative of such a trading platform was conceived by the Chief Minister of Karnataka state, India and the NCDEX Spot Exchange has helped to conceive and provide such an effective and robust trading platform to the traders, producers and farmers. In Gulbarga, Karnataka, where the project is implemented, traders trade 500 MT (Metric ton) of Tur in lots varying from 1 bag to 50 bags on daily basis. New APMCs are being added every month, across the state of Karnataka. Till date 14 APMC are using eMandi application, (NSE.IT 2014).

Mandi Trades Application

This mobile application aims to assist farmers to buy farm products from the other farmers directly. It was launched in 2014 and is a location based trading platform provided by Appface Technologies in Bangalore, India. This application runs on Android platform as on today hence supports a variety of smart phones all supporting Android based operating system. It takes into account the location using the GPRS connection of the handheld device and lists the available sellers from the nearby location. Using this application, the farmers can directly put their produce on for sale (The Hindu Business Line 2013 and Varghese 2014). The daily agricultural prices are updated on a daily basis by the Indian Government portal. The system helps sort the price wise listing of commodities out up for sale by farmers. The grocery shop owner may search for deal and contact the farmer directly over phone.

The e-Mandi application offers advantages where it provides a transparent platform for buy and sell of agricultural produce, integrates major APMCs and markets across India, allows SMS based trading, delivers stock prices and reports on SMS, has stock and inventory tracking mechanism and it runs on windows, mobile and android platforms (Mrunal 2013 and eMandi 2014). On the other hand it also has some shortcomings wherein the regional language application support is still unavailable. Also the farmers have to trade via the traders which may introduce some lag period. On the other hand the application named Dynamic Pricing Platform delivers the cash grain prices and gives the option to potential buyers to select the list of farmers in their local area and submit private bids, (Heikes 2011, Woodill et al. 2012).

The reason for discussing Mandi Trades application is it is one of the applications that exist which directly assists the farmers as discussed in providing a listing of nearby sellers and delivers the commodity prices fed by the Government of India portal that gets refreshed on a daily basis. The farmers here additionally can directly put their products for sale in the system (The Hindu Business Line 2013 and Varghese 2014). The application also helps understand the trends of rare items which can enable farmers to plan for their increased production for earning more profits. However, the application lacks regional language support as of now which makes it difficult for the local farmers to make maximum benefit out of the same. Further it is only intended for bulk buyers hence the small scale buyers cannot make use of this application. Comparing Mandi Trades with the Agricharts Mobile application, the later offers a real time and historic quotes and charts for commodities with their analysis (Heikes 2011, Woodill et al. 2012).

Discussion and Conclusions

Mobility in agriculture will continue to enhance the quality of agriculture and help the farming community toward improvements in rural livelihoods. These applications offer innovative, dynamic and interdisciplinary services. However, in the modern world as of today, there still exist various ground level challenges that persist. A number of challenges for mobile applications in agriculture exist, few of which was discussed in this paper through two case studies. It is essential that the applications convey information in the regional/national language as an option if needed. In addition, it is clear that certain core functionalities should be provided in regional/national language for adoption and distribution of relavent information. Today smart phones are available in a variety of platforms like Windows mobile, Android and iOS in both mobile and tablet versions. The mobile applications should run on multiple platforms to allow for greater technology transfer.

Cost is another consideration in the uptake of such applications; with free of cost access the best means for fast adoption. The government may think of providing some subsidy in the cellular data charges to the farmers or providing wi-fi zones at a low cost. The applications may introduce some basic features and provide advanced or customizable features at a later stage or on minimal chargeable basis. The application version should be standard and the users should be well informed. Application training is very essential to get a mass buying, acceptability and to make the maximum utilization of the application. The demonstration videos and support of various kinds makes it easy to get a visibility. Applications where cash management and payments is supported, one needs to ensure that money laundering is prohibited. Hence in such case, the regulatory mandates need to be adhered strictly. Many other researchers have found similar challenges for mobile applications in the agricultural domain, (Aguero 2009, Rashid et al. 2009, Kuek et al. 2011, Manimekalai 2013). To overcome these challenges, efforts are being made by both farmers as well as producers of these mobile applications. There is a huge potential for innovation through mobility in agriculture. By addressing or overcoming the above shortcomings there will be immense opportunities that can be offered to the farming community at large.

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