MOBILE APPLICATIONS THE FUTURE UNFOLD IN INDIAN AGRICULTURE

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Abstract— India is a nation where farmland mostly depends on rain and where farms provide livelihood to most of the population. By mid to end June, the monsoon usually covers most of India, bringing down the mercury, soaking the ground and swelling the rivers that are the lifeline of Indian agriculture. Most of the farmers believe that their yield is dependent on the god's mercy until they bring their produce to their home. What if rain god bullies farmers at the time of harvesting? In India many occult rituals are being performed to please the rain god. The major challenge is to develop technology which can defy all the myth which persist among Indian farmers and move towards new horizon. Farming methodology varies from one geographical location to the other. It is difficult to have unified approach for building mobile application which will serve purpose of Indian farmers. Farming is a more time-critical and information-intense business hence for better productivity farmer need mobile application which can help them to make informed decision. Distance and time can be eliminated to benefit Indian farmers in all aspects at affordable prices. To do this Indian farmer needs realistic mobile applications which will offer tailor made solution to meet their actual needs. Mobile phone subscription has increased exponentially in India now it is high time to think much ahead. Smart phones and tablets are available at affordable price often available second hand which makes it cheaper than alternatives. Farmers can use its capabilities for accessing and dissemination of information and knowledge which will reduce the cost of production and transaction facilitating trade, outsourcing business support. Mobile application can be developed for supporting planting decision to selling their produce at the wholesale market which will be game changer in small holder agriculture. Farmers can also use rich user interface smart phone to control automated farming tools. Such application will play the vital role in value chain of Indian Agriculture. The objective of this paper is to do field review how mobile application can unfold future agriculture practice in typical Indian village boundaries.

Index Terms— Expert System, Farm Automation, ICT, Mobile application, m-ARD, Mobile ERP, Mobile DSS.

I. INTRODUCTION

Mobile applications will impel Indian farmers to unfold the future agricultural trends. A typical Indian farming exercise involves sharing of common critical information such as weather forecasting, usage of right technology for

seeding and cultivation exercise, application of manure and pesticides, crop harvesting, depiction or forecasting of market demands. Right information in right time will be key tool for agriculturist. It will help them to take timely action, prepare strategies for next season, speculate the market strategies for next season and avoid unfavorable circumstances. Intelligent decision support system will assist determining optimal machinery management practices at farm level. Farmers can use rich user interface of smart phone to control automated farming machinery. In order to achieve above said mission the creation of right mobile application is rudimentary and vital activity which will attract all rural village bodies and contribute to economy of the nation.

II. OBJECTIVES OF STUDY

The objectives for the paper is to investigate the following Research Questions

A. Research Question 1 (RQ 1)

What are the current trends in ICT perceived by Indian agriculture? How these initiatives transformed the agriculture scenario in the rural belt.

B. Research Question 2 (RQ 2)

What are the milestones achieved by Indian farmers using different ICT program across the different parts of India?

C. Research Question 3 (RQ 3)

What are the readiness and barrier level of farmers to accept mobile applications (m-apps) and mobile applications for agricultural and rural development (m-ARD apps)?

D. Research Question 4 (RQ 4)

What are the existing m-ARD apps across the globe and how it has helped farmers?

E. Research Question 5(RQ 5)

How mobile application can be integrated with farm machinery? This line investigation will focus on how to provide one point platform independent solution to control various automated farming tool at minimal cost.

III. PERVASIVENESS OF ICT IN INDIAN AGICULTURE AND ITS IMPACT

ICT in agriculture is most eminent paradigm focusing on the enhancement of agriculture and rural development in India. It provides right information at right time which can be used in value chain of Indian agriculture. Many projects on ICT has been initiated and implemented successfully by public private partnership, government, researchers and various institutions. ICT has positive impact on agricultural development but it is still in natal stage in India. Many farmers are not availing the actual potential of ICT due to poverty and social constrains, illiteracy, language barrier and unwillingness to adopt new technology. Hence ICT is yet to reach with maximum potential in Indian village.

IV. ICT INITIATIVES FOR AGRICULTURE DEVELOPMENT IN INDIA

A. E-Choupal

Indian farmers depend on several actors, right from the input providers to selling their produce. Each actor adds their profit margin, hence increases the cost of product. Some agents even try to block the market information. There is very little margin between production cost and selling price of their produce. To protect farmers from such practices, the International Business Division of Indian Tobacco Company (ITC-IBD) came out with an e-government initiative called e-Choupal (which means a village meeting place). Each e-Choupal is equipped with a PC, internet connection, printer and Uninterrupted Power Supplies (UPS). In case the power supply is erratic, a solar panel is provided and if internet connectivity is not up to the mark, then a Very Small Aperture Terminal (VSAT) connection is provided along with another solar panel to support that.

B. Drishtee

Drishtee is a rural model of distribution and promotional network for consumer goods and basic services. Information is provided to the users in the form of services via internet (Government of India, 2003). Drishtee made its presence in Dhar, Seoni and Shahdol districts in Madhya Pradesh, Sirsa district in Haryana and Jalandhar district in Punjab. A village entrepreneur is trained to handle the software that works on MS SQL Server at the back-end and runs on ASP, Java script, VB Script at the front-end. The hardware includes a web server, a district server, kiosks and dial-ups. The district server regularly gets connected to the web server and performs updates. The database of kiosk gets updated whenever the kiosk gets connected to

the district server or the web server. Information center centers have been established to cater to 25–30 surrounding villages and buildings of Gram Panchayats.

C. Akashganga

Akashganga uses ICT to facilitate rural milk producers by integrating all the operations of rural co-operative society right from milk procurement to accounting. First pilot model of Dairy Information System Kiosk (DISK) is currently under implementation at Uttarsanda Dairy Cooperative Society in Gujarat. Each farmer is given a plastic identification card. When farmers arrive at the Raw Milk Receiving Dock (RMRD) counter, his/her identification is updated in the PC. The milk is emptied out in a steel trough kept over a weighbridge and the weight of the milk is displayed as well as entered into the PC. One operator is required for filling of cans and another for measuring fat content and updating the PC. The infrastructure used to carry out these operations includes weighing balance, microprocessor, printer, milk analyzers and a display.

D. Gyandoot

Gyandoot has been established as community-owned, technologically innovative and sustainable information kiosks in a poverty-stricken, tribal-dominated rural area of the state of Madhya Pradesh. The server system runs on Windows NT with Internet Information Services (IIS) server; client PCs run Windows 98. Information kiosks have dial-up connectivity. The server hub is housed in the computer room in the district panchayat. Kiosks have been established in the village panchayat buildings. Typically, villages that function as block headquarters or hold weekly markets in tribal areas, or located at major junctions, were chosen for setting up kiosks.

E. Jagriti E-Sewa

The emphasis of Jagriti is deployment of appropriate, affordable, scalable and sustainable technologies available in the developing countries. The system works on LINUX, which is a 'License-Free' operating system. Old computers (e.g. Pentium I) are used in some places. The project uses dial-up telephone lines. The whole system can be adapted to any language in the least time. The kiosks are located in villages where there is a sizeable flow of public on a regular basis. Each kiosk is set up to serve about 25,000–30,000 people and is owned and operated by a 'Kiosk Franchisee' who is typically an educated youth or an ex-serviceman. It is ensured that the kiosk generates adequate revenue streams so as to justify its operations.

F. Rural Access to Services through Internet (RASI)

Sustainable Access in Rural India (SARI), now renamed as RASI, provides internet and voice connectivity to the villages of Madurai district in Tamil Nadu. The project has 100 internet kiosks in more than 100 villages. Current network technology is based on the CorDECT that was jointly developed by the TeNet group at IIT Madras, Analog Devices Inc. and Midas at Chennai. A CorDECT access centre is located roughly 25 km from the kiosks. Internet facility is provided with the help of Wireless Local Loop (WLL). Each kiosk is connected to the website containing information relating to revenue, registration, rural development, education, health, agriculture and animal husbandry. The major source of income for the operators has been computer education for children.

G. Tata Kisan Kendra (TKK)

Tata Chemicals Ltd. came out with TKK to help farmers in states of Uttar Pradesh, Haryana and Punjab. The TKK tracks key parameters relevant to farmers, such as soil, ground water and weather on a real-time basis with the help of Geographic Information Systems (GIS). The GIS software provides spatial information regarding roads, rivers or buildings. It works by imposing layers of data in digitized maps with information about administrative, socio-economic and physical set-up. Satellite image processing can help detect unproductive farming practices, track the progress of insect attacks across states, get crop estimates or update maps. Currently there are 11 main kiosks and around 300 franchisees TKKs and is looking to set up 40 more kiosks and 800 franchisees to serve 48,000 villages.

H. LokMitra

LokMitra project was developed by the National Informatics Centre (NIC) in Himachal Pradesh, in order to provide easy access at remote areas and to redress complaints. The LokMitra Intranet in Hamirpur district consists of two Pentium IIIbased servers, with four Pentium III-based client systems. The servers and the clients are connected on a LAN. The hub is placed in the Deputy Commissioner's office. The client systems are used by the officials from concerned departments for answering the complaints and queries received and for updating

with information. The LokMitra software interface is web-enabled, user-friendly and has two modules one for the citizen information centers and the other for the control room.

I. N-Logue

N-Logue Communications Pvt. Ltd. provides telecom and internet services in small towns and rural areas of India. For operational purposes N-Logue divides the country into service areas corresponding approximately to a taluka(Tehsil). Eighty-five percent of taluka headquarters in India have optical fiber today which acts as the backbone for telecom and internet connectivity. N-Logue ties up with a number of content providers such as state government, rural development ministry, agricultural ministry and fertilizer/pesticide manufacturers. N-Logue employs WLL technology as the basis for its village-level communications. The CorDECT technology used operates on the same principles as regular wireless technology, providing internet access at 35–70 kbps to 1 gbps. The subscriber set can transmit both voice and data signals simultaneously to an access centre which must be located within a 25 km distance.

J. Bellandur Project

Bellandur Project is a gram panchayat e-government solution. Working closely with the panchayat members and village residents, the software was designed to suit the needs of panchayat administration. Bellandur Rational Unified Process (RUP), a set of software engineering tools, enables a phased and iterative approach to e-government. At present, the panchayat office has three computers, one for each of the bill collectors. All the district offices, taluka offices and gram panchayats are connected. The committee meetings are aired on the cable television.

V. BOTTLENECKS OF ICT IMPLEMENTATION IN INDIA

The most common hurdles in implementing ITC projects are the poor connectivity in rural areas due to lack of telecom network, frequent power failures, insufficient funds to equip the kiosks with the latest infrastructure and difficulty of literate people to cope with the new technology. The bottlenecks faced by the typical rural ITC projects in India are listed as following.

A. E-Choupal

Outdated infrastructures are available to the “sanchalak”.

B. Drishtee

The dusty environment in the villages created difficulties to operate computer systems and lack of adequate power supply halts the system operation. People are not willing to accept the project until the benefits were understood by them.

C. Akashganga

Little rural data were readily available for planning purposes and limited services provided due to poor infrastructure. Poor farmers missed the opportunity of working as kiosk operators.

D. Gyandoot

Operations were interrupted due to telecom network disconnections and power failures. Increase in cost of operation, as diversified services are included in the system. It lacked highly skilled personnel to offer its diversified services.

E. Jagriti E-Sewa

Frequent disconnections as the system uses dial up connection where the lines are busy.

F. N-Logue

Difficulty in adopting the new CorDECT technology as it has to meet the standards specified by the telecom operator.

G. Lokmitra

Due to unstable telecom network there is frequent disconnections.

H. Bellandur Project

There was no financial support of government or private institutions. Readiness and barrier levels of farmers to accept M-apps ans m-Ard apps

VI. READINESS AND BARRIER LEVELS OF FARMERS TO ACCEPT M-APPS ANS M-ARD APPS

Mobile applications cannot be airdropped in case of Indian farmers which are costly, complex, and irrelevant. Some common problems in adopting m-apps and m-ARD apps will be illiteracy, availability of relevant and localized content in their respective language. Socio economic situation and information priorities of farmers cannot be overlooked while developing such application. Innovative m-apps and m-ARD apps will defy traditional approach of agriculture and provide solutions to numerous challenges in terms of crop planning for next season, choice of inputs, production, and marketing. Meanwhile reduce time in completing formalities related updating land records that are required in order to avail government benefit and schemes.

VII. LATEST AGRICULTURE M-APPS

Some of the popular M-apps used worldwide [1] are listed as following.

A. Simplot Spray Guide

The Spray Guide app accurately identifies the ideal mixing order of crop protection products. The app streamlines the process of mixing, spraying and record keeping.

B. Mobile Farm Manager

Mobile Farm Manage provides access to farm and field information through their mobile device. It has several features like field maps, historical reports, GPS tracking, field navigation and soil sampling grids.

C. SpraySelect

SpraySelect enables users to efficiently choose the spray tip for a given application. It takes speed, tip spacing and target rate, droplet size category as input for applying fertilizers.

D. Connected Farm

Allows farmers and agronomists to map field boundaries, enter scouting attributes for pests (weeds, insects, diseases), take geo-referenced photos and manage collected data online through Trimble's Connected Farm.

E. AgStudio MAP

Optimized for mapping field boundaries and recording data associated with precision ag soil sampling programs. The app wirelessly transmits soil sample work order information and completed job files.

F. Onsite

Onsite is a cloud-based, mobile and desktop app that assists with file management and communications to and from the field by socially connecting people.

G. Maximum Return to Nitrogen (MRTN) Calculator

The app helps to determine the optimum nitrogen rate for corn and plan for split applications of nitrogen. The MRTN calculator enables users to choose from various sources of nitrogen, add in stabilizers and calculate the corresponding application costs.

H. Weed Manager PLUS

The app provides weed management recommendations by region and crop, calculates potential incentives for farmers who use endorsed residual herbicide products and delivers a tank mixing tool and measurement conversion calculator.

I. agSeedSelect

Lets users create, store, e-mail and print a custom seed guide tailored to their specific geography and crops. Featuring videos by territory agronomists, the app provides detailed information on products for corn, soybeans, cotton and other crops.

J. AgFleet

Agfleet is a Web-based service. Functionality includes AgFleet account synchronization, boundary and attribute logging, soil sampling, option to provide driving directions to a field, and in-field navigation to target soil sample points.

K. LoadOut

Allows drivers to control grain loading from inside the cab, helping to streamline the process and increase driver safety. LoadOut enables drivers to view a camera positioned above the grain loader from their iPhone while in the truck. From a push of the button, they can begin – or stop – the loading process.

L. Optimizer 2.0

The newly updated Optimizer 2.0 allows users to upload GPS soil sampling data, including phosphorus, potassium, pH and organic matter.

M. AGCOMMAND

App for its AGCOMMAND telemetry system gives the user real-time access to valuable machinery information. It features the ability to show turn-by-turn directions, the history of machine status and machine data, ability to compare the performance of multiple machines and user-defined alerts from vehicles and machines.

N. mKRISHI

The mKRISHI enables farmers to send queries, comprising of text, voice and pictures, specific to their land and crop to agricultural experts, using their mobile phones. Farmers can send pictures of their crops and pests captured with mobile phone cameras, sensors provide farm specific soil and crop data, weather stations provide microclimate details and voice based querying system gives freedom to the farmers to ask any query in their local (natural) language. After analysis of the available information, the expert's advice on the farmer's query is provided on the farmer's mobile phone.

*O. **M-PESA***

M-PESA is an application for mobile payment which operates in number of countries and millions of users.

VIII. M-APPS THE FUTURE UNFOLD IN INDIAN AGRICULTURE

Mobile phones are multifunctional device. Indian farmers can do much more than simply placing voice call. As networks and devices acquire more capabilities richer uses of phones are unfolding. Farmers can use camera phones to send images, access internet which provides affordable way to access information.

M-apps are designed to take advantage of mobile technology and can be developed for technology beside mobile phone. Since mobile phones have key advantage of affordability, wide ownership, voice communication and instant and convenient service delivery. M-apps can integrate agriculture value chain of Indian agriculture which could provide significant economic and social benefit as shown in Fig 1. M-apps can provide access to valuable information which is weakness of Indian rural markets like price negotiation and other value chain support. It can provide timely information access to extension service such as advice on agriculture production, marketing and technology. It can be further expanded to access finance and insurance products.

IX. DESIGN INITIATIVE TYPOLOGY

Mobile application can designed keeping two typologies as shown in the Fig 2 and Fig 3. First typologies focus on services that operate through mobile phone to improve agriculture livelihood. Second typologies focus on various forms that might develop agricultural process.

Design Typology 1: Service to improve agricultural livelihood

A. Trade Relationship Management

Mobile application can be developed to provide efficient trading system which provides information about best buy and sale deal.

B. Logistic and business process management

Mobile application can be developed to provide efficient business process in rural as well as urban area for example transporting agricultural commodities, tracking goods etc.

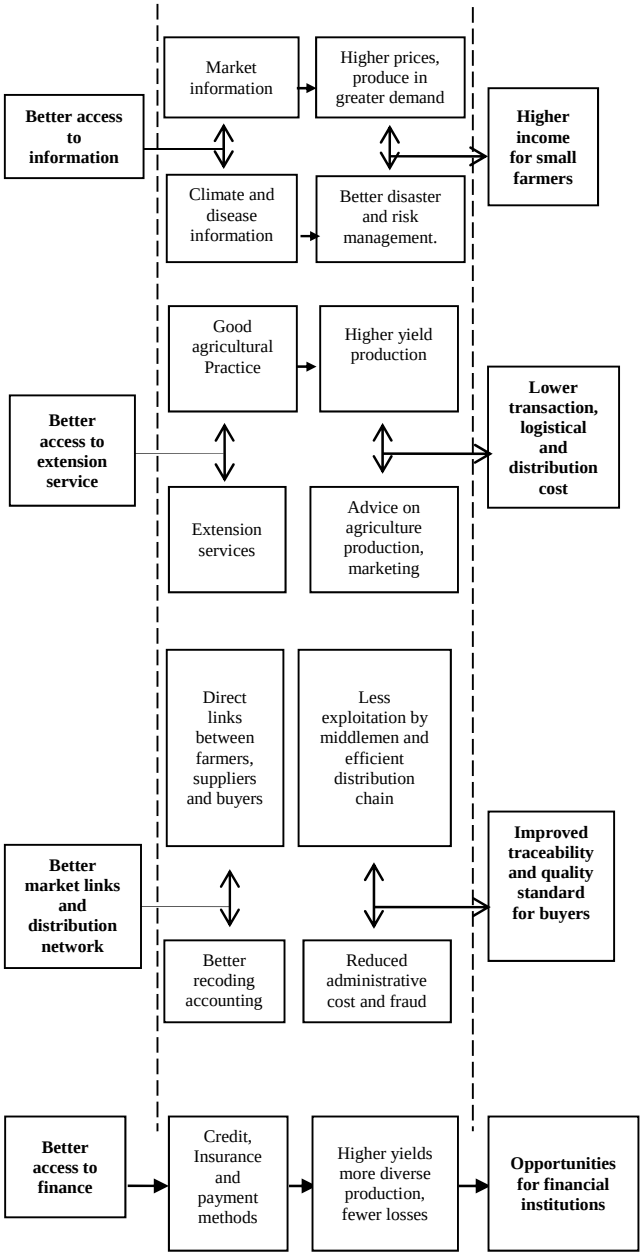

Fig. 1. m-apps benefit in Indian Agiculture supply chain

C. Financial service

Mobile application can be developed to provide financial service such as crop insurance, loan etc for farmers and agents involved in agriculture value chain.

D. Quality control

Mobile application can be developed for communication between seller and buyer, producer to felicitate exchange of quality product for example grading, product

standard certification, verification of origin of products etc.

E. Market information

Live market information about agricultural input and produce of different location will play significant role. This application service will coordinate the procurement and distribution of produce along the value chain. The use of mobile technology expected to improve market transparency and efficiency and strengthen the farmer's position.

F. Other support service

Mobile application can be developed to facilate efficient trading system which provides information about best sale and buy opportunities to deliver traditional and innovative service for example live market feed, SMS marketing,job portal, online marketing etc.

Each user of Mobile application has different intrest and information flows though the value chain need to be managed.

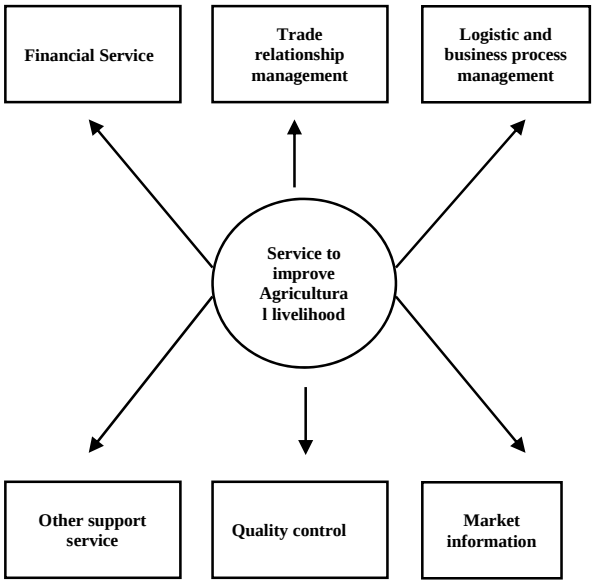

Fig. 2. Services to improve agricultural livelihood

Design Typology 2: Develop agricultural process

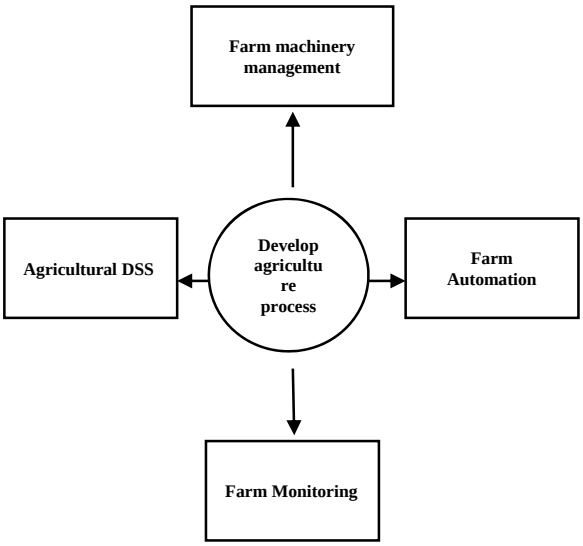

Fig. 3. Develop agricultural Process

There is tremendous scope for mobile applications along with the value chain to develop agricultural process as shown in Fig. 3. It will be boon for Indian farmers if they have mobile application based Decision support system in their hand along with localized contextual information i.e. delivering location specific information based on microclimatic pattern soil and water condition throughout the cropping season. Mobile technology with integration of wireless sensor network (WSN), Geographical Information system (GIS) can further improve agricultural process. These technologies will help farmers to monitor their crop more sophistically. Modern farm machinery can also be integrated with mobile technology to move towards new horizon.

Fig. 4 describes about the block schematic of proposed integrated design model of mobile application.

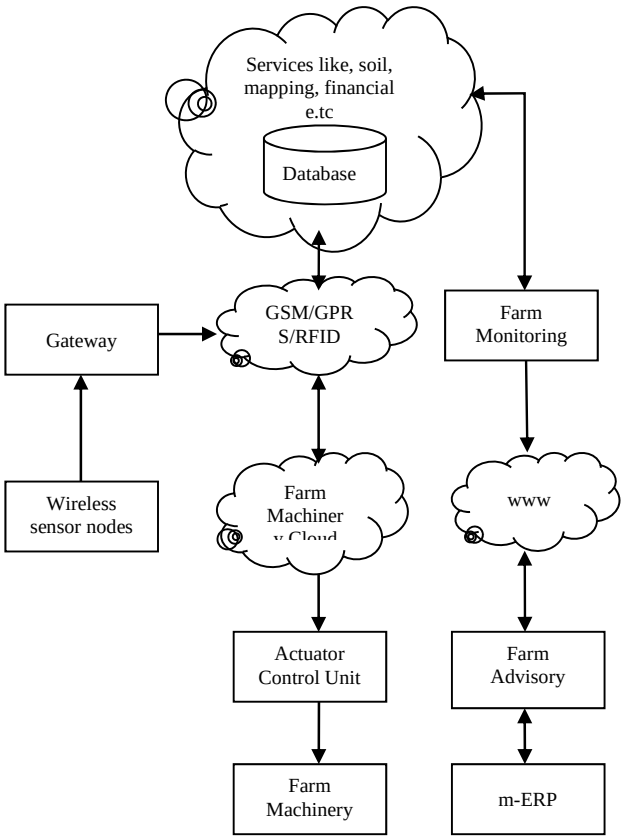

Fig. 4. Block schematic of proposed integrated model of mobile application

X. CONCLUSION

Indian farmers desperately need mobile application which can share and schedule farming information in the Indian typical Indian village boundaries. Mobile phone is evolving rapidly, the past experience suggest that it has immense potential to improve livelihood of Indian farmers by empowering various services which were not available for unconnected portions of rural population.

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