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RESEARCH PAPER

Mobile based agricultural Apps and portals for farmers' welfare in India

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Abstract: Agriculture is the backbone of Indian economy and plays a key role in improving standard of living of Indian farmers personally, socially and economically as well. In India, over 58 per cent of rural households depend on farming. India has the largest public extension system in world, and huge gaps in transferring recent farm technologies to farm fields. ICT and IoT tools have advantage to reach the end users with real-time information. Among ICT tools, utilization of mobile phones is increasing a lot which is changing the communication process related to agriculture and other sectors. The introduction of mobile phones has led to improvement of various agricultural applications and portals for the welfare of farmers and stakeholders. A mobile application is software on a mobile phone that enables a user to access specific information, make payments and transactions, sends Short Message Service (SMS) etc. The application is downloaded (free/payment) from an online store and may require a internet connection to function effectively. It is easy to use and access, details of package of practices, pest and disease management, nutrient management, market intelligence, weather forecast and advisory services are available in our mobile handset itself. Information will be effectively reach farmers in a timely manner. Government has initiated many apps and portals that facilitate agriculture and farmers. These mobile apps will be updated frequently with new information and success stories. Kisan Suvidha, Pusa Krishi, Soil Health Card app, IFFCO Kisan app are some of the agricultural mobile applications which are developed by various public and private collaborations to provide details for farmers welfare. These apps provide details in several languages such as English, Hindi, Tamil, Telugu and other regional languages. Portals such as TNAU Agritech portal, Farmers portal, Rice knowledge portal etc. also facilitates with valuable information. Expert systems on various crops provide specific information related to particular crops. In such ways, mobile technology is transforming access to information. As the number of apps continue to increase it is important to be selective in choosing the app, review and ensure that the App provides credible and current information and meets requirements. This paper examines various and recent ICT and IoT tools facilitates in technology, market, weather and processing information dissemination to farmers and extension professionals.

Key words: Applications, Expert system, Mobile phones, Portals

Introduction

Agriculture is the backbone of Indian economy and plays a key role in improving standard of living of Indian farmers personally, socially and economically as well. In India, over 58 per cent of rural households depend on farming. India has the largest public extension system in world, and huge gaps in transferring recent farm technologies to farm fields. In recent times, Information and Communication Technology (ICT) tools are utilized in an effective and efficient way in agriculture sector by farmers and stakeholders. ICT and IoT tools have advantage to reach the end users with real-time information. ICT is used as an umbrella concept that encompasses all forms of delivery, such as networks, electronic devices and mobile applications that help to use technology to transfer information. In recent times, Information and Communication Technology has proven to be highly beneficial for farmers, especially small and marginal farmers in aspects of marketing, increased income etc. Farmers have been granted the right to express their thoughts, experiences and innovative ideas with the help of ICT. More exposure has been provided to farmers and encouraged them to use science that looks at agriculture from an integrated perspective. Among ICT tools, utilization of mobile phones is increasing a lot which is changing the communication process related to agriculture and other sectors. The introduction of mobile phones has led to improvement of various agricultural applications and portals for the welfare of farmers and stakeholders.

ICT and ITS Importance

ICT are emerging as a vital tool for societal growth and are driving forces in economies all over the world. ICTs are no longer limited to promote high end research and development; all sectors of the economy have made substantial changes in lifestyles and productivity levels through emerging technologies. Radio and television have long been used in India to reach rural communities with new agricultural and rural developmental knowledge. In addition to radio, television and print media, new ideas are being used for dissemination of agricultural knowledge in the form of ICT enables portals, kiosks, digital imaging technologies, social media etc. In last two decades, improved availability and access to new ICT technologies, especially personal computers Internet and mobiles have provided a much wider range of options for capturing, storing, processing, transmitting and presenting information in multiple formats.

In this context, ICT has the potential to revolutionize the Indian agricultural sector in terms of significantly improving productivity, production and profitability of small and marginal farmers, tenant farmers and female workers (Amrit Patel, 2016). Farmer can access and use information related agriculture and allied sectors. Among all ICT tools, telephone services have been made available in small towns, markets and villages. Mobile and Telephone which is a powerful electronic machine that was a farmer's dream earlier has become a reality as the farmers can immediately make use of it to address their field problems and other farm related problems (Manhas *et al*, 2005).

With rapid spread of internet facility in rural areas ICT now has the potential to significantly contribute towards solving one of the most important major national concern namely Doubling Farmers' Income (DFI) by 2022 through dis-intermediation in both procurement of inputs and services, minimizing the costs through e-procurement and maximizing their share in consumer price through e-marketing by bringing producers and sellers together and most importantly by providing individualized Extension Advisory Services to majority of farmers.

Mobile Applications and Portals

In developing countries, the rise of mobile communication technology is opening up a slew of new possibilities for social empowerment and grassroots innovation. The contribution of mobile applications to Agricultural and Rural Development (ARD) by providing access to knowledge, markets and services to rural inhabitants is one of the areas of potential effects (World Bank, 2012). A mobile application is software that allows a user to access specific information on a mobile phone or tablet; make purchases and other transactions; send messages and so on. The application (app) is downloaded for free or for a fee from a wireless network or from an online store and it may require a internet connection to run properly.

The key benefits of mobile apps for farmers are that mobile farmers can easily access information. The information is stored in the mobile handset itself for easy access, for example the details of package of practices, pest and disease information and scheme related information etc. Wherever the information is dynamic in nature, for example weather details, market prices, advisory services, the mobile app requires Internet connectivity to fetch the data from the back-end server databases. The SMS service, in particular, is just a one-way information provider to the agriculture community. For day-to-day farming, the farmer needs two-way communication and complex data.

Farmers need timely information in response to their specific needs. There are mobile applications that provide latest agricultural information about trends, equipment, technologies and methods being used, help identify pests and diseases, provide real-time data about weather, early warnings about storms, local markets offering best prices, seeds, fertilizers etc. In addition, farmers can also interact and get guidance from agriculture experts across the country via the apps. These apps help in providing market information, facilitating market links, providing access to extension services, farm related information etc.

The Government of India has introduced a range of web based and mobile based applications, free of charge, for the benefit of farmers and other stakeholders, to disseminate information about agricultural activities. These applications are available for download from official mkisan.gov.in website or from Google play store. The apps produced by agricultural organisations, private sectors and NGOs are also available. These apps are disseminating agricultural research and extension information to farmers and other stakeholders, as well as facilitating information exchange among stakeholders.

List of some of the important mobile based apps and information on portal and expert system developed in agriculture are as follows:

1. Kisan Suvidha

Kisan Suvidha is an omnibus mobile app developed by Ministry of Agriculture and Farmers Welfare, Government of India in order to help farmers by providing relevant information. The information is currently provided in English, Hindi, Tamil, Gujarati, Odia and Marathi. The following features includes about information obtained from this app by farmers:

- **Weather:** Information includes details of humidity, temperature, wind and rainfall for the current day and the forecast for future. Extreme weather alerts like cyclones or hailstorms etc. are also informed.
- **Market Price:** Latest market prices of commodities in the nearest mandi are provided on daily basis.
- **Agro Advisory:** Agro advisory services will be provided to farmers and stakeholders on their own regional languages.
- **Soil Health Card:** Information pertaining to soil health is available for farmers who have registered.
- **Dealers Information:** Provides information on seed, pesticides, fertilizer, farm machinery dealers.
- **Plant protection:** This section gives pest, weed and disease-related information as well as management practices for each stage of crop development from Seedling/nursery to harvesting. One can also upload a picture of the affected crop and get a response.
- **KCC:** The app also directly connects the farmer with the Kisan Call Centre (KCC) where technical graduates answer farmers' queries.
- **Cold stores and Godowns:** Information on cold stores and godowns is also provided.

To begin with this app, a farmer must register his or her mobile contact number, select appropriate language and provide information related to his/her own state, district and block.

2. Pusa Krishi

This mobile app was launched for farmers in order to take the technology to farm fields. This app was developed by Ministry of Agriculture and Farmers Welfare, Government of India. Farmers can use this app to learn about new crop varieties

produced by the ICAR, resource saving cultivation techniques, farm machinery tools and implements and other development technologies. In this app, a feedback section is available that enables the farmers to have a conversation with stakeholders on a real-time basis.

3. Soil Health Card (SHC) Mobile App

Soil Health Card (SHC) Scheme is a Government of India scheme promoted by the Department of Agriculture, Co-operation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare and being implemented in all States and Union Territories. A Soil Health Card provides each farmer with soil nutrient status for his/her land holding and also provides advice on fertiliser dosage and soil amendments needed to maintain long term soil health. Every three years, all landholders will obtain SHC that will allow the pattern of soil fertility changes caused by nutrient absorption by plants or other natural causes to be recorded. This will also help to take appropriate corrective action on the deficiencies in soil nutrients found with the help of SHC.

NIC has designed and created an Android mobile application for SHC to further simplify the data entry work for sample registration. When "Location"is turned on, this app will automatically captures latitude and longitude. Through this mobile app, details about farmer, land, crop and fertilizer will be collected.

4. IFFCO Kisan Agriculture

IFFCO Kisan Agriculture app was developed by Indian Farmers' Fertilizer Cooperative Ltd. This app allows access in the form of text, photos, audio and video in the selected language, to different modules, including agro advisory, weather details, market prices etc. The app also offers helpline numbers to get in touch with Kisan Call Centre Services. The app supports eleven languages across India including English. This app provides the information related to weather, market price, agro advisory etc. Some other features include:

• **Ask the Experts.** Farmers can talk to Agriculture experts for advice. They can take a picture of infected plant and send it to the experts and get the customized agricultural solutions through voice call with the experts.

5. APEDA Farmer Connect

APEDA Farmer Connect app was developed by Agricultural and Processed Food Products Export Development Authority (APEDA). A farmer may use this app to apply for farm registration and approval from the state government, as well as lab sampling from approved laboratories. The farmer is able to track the status of applications. The information can only be accessed by an authorised state government official, farmer or a registered laboratory. State Horticulture Departments can use the mobile app to collect information about farmers, their lands and products of farm and also farm inspections on real time basis. This app has in-built GPS system to recognize the location of the farm.

6. eNAM Mobile App

eNAM Mobile App was developed by Small Farmers' Agribusiness Consortium (SFAC), Ministry of Agriculture & Farmers Welfare, Govt. of India. NAM is a Govt. of India sponsored pan-India electronic trading platform that connects existing mandis to establish a single national market for agricultural commodities. The aim of this app os to encourage or motivate remote bidding by traders and to provide farmers and other stakeholders on their smartphones with access to arrivals and price related details.

7. riceXpert

This app was developed by ICAR-National Rice Research Institute (NRRI), Cuttack. This app is available in two languages viz. English and Odia. The main aim of this app is to provide the farmers with the details regarding latest rice technologies on a real time basis. Some of the features includes:

- This app helps with diagnosis of pests and diseases, nutrient management etc. on a real time basis and providing customized solutions to farming community.
- Also provides with agro advisory, details about new rice varieties, new tools and implements etc.
- Provides suitable fertilizer recommendation on the basis of soil nutrient availability.
- Farmers and farm women can use this App as a diagnostic tool in their rice fields and also make customized queries through text, uploading photo or recorded voice which would be addressed by a panel of experts on real time basis with quick solution along with recommendations through SMS.
- Also provides a platform for the farmers who have no organized way to sell their products. Farmers can post their rice or rice related products for display to buyers. The buyer can access the detailed information about the products through the app and get the products at the best prices through direct interaction.

Portal and Expert System Initiatives at TNAU

Tamil Nadu Agricultural University (India) has investigated the power and potential of ICT involvement in farm technology transfer, with the goal of speeding up the flow of information about the technology, market related information, weather report etc. to public extension system and then ultimately to farming community. Effort on promotion of ICT will help the 'young minds' to be in the farming. TNAU is very popular among the various Agricultural universities of India for its own portals named "Agritechportal" and also for its own Expert system on various crops. Let's see here specifically about these two mobile based online solutions for problems of farmers. Important ICT initiatives by TNAU are as follows:

1. TNAU AGRI TECH PORTAL
2. TNAU Multi Video Conference facility
3. Dynamic Market Price Information for Perishable Commodities
4. TNAU- Agricultural Market Information System
5. TNAU-IIT, Chennai Mobile Agro Advisory Services
6. TNAU Video Modules

7. TNAU Plant Protection Information
8. TNAU e-Course information
9. TNAU Weather Information Network
10. TNAU-ICAR Mobilizing Mass Media for Sharing Agro Information
11. TNAU-online e-Radio

A successive extension approach will depend on how it enhances the information flow along the members of agriculture value chain, and whether this is done sustainably and effectively. Sustainability and effectiveness of extension are determined by the four factors, the type of information provided, how and to whom the information is provided, the strength of feedback in each link, and the capacity of the approach to provide relevant information.

Agritech Portal- Transforming the Lives of Farming Community

Agritech Portal is a new initiative by e-Extension Centre of Directorate of Extension Education, TNAU to eliminate the communication gap between the university scientists, agriculture officials and farmers. This dynamic portal holds around six lakh pages in Tamil and English with multiple media content. The Portal (http://agritech.tnau.ac.in) has been dedicated to service on 27th Sep, 2009 for the benefit of field extension officials and other stakeholders. Agritech portal transfer the agriculture related information and new technologies to the farmers and extension officials. Accordingly, the Government of Tamil Nadu has taken-up the portal initiative as flagship programme under National e-Governance and Tamil Nadu State e-Governance to share all developmental programmes for the well-being. TNAU agritech portal has also been awarded the 'Best e-governance agri portal' by Government of India during 2010-11 and 2014-15.

Expert System in Agriculture and Animal Husbandry

An Expert System (ES) is a computer programme designed to stimulate an expert's problem solving actions in a narrow domain or discipline. ES is also called as Knowledge Based System (KBS). For the decision making and location specific technology dissemination process, an expert framework could be created. A typical application and subfield of artificial intelligence is an expert scheme. The Expert System helps to pick crops or varieties, to diagnose or classify pests, diseases and to make important management decisions.

As network project of Indian Council of Agricultural Research, the expert system was developed for agriculture (Paddy, Sugarcane, Banana, Ragi and Coconut) and animal husbandry for the three states in their respective languages *i.e.*, Tamil Nadu (Tamil), Karnataka (Kannada) and Kerala (Malayalam) to provide timely expert advice with ICT initiatives to farmers. The Expert System developed to cater to the needs of Farmers, Extension workers, Scientists, Students based on this, the three components were developed. They were:

i. Decision Support System,
ii. Crop Doctor / Health Adviser
iii. Information System.

a. Information System

Information system component is an internet based system that includes static information where all the complementary and technological details about various crops were available. Extension functionaries, research scientists and policy makers are using this information for their reference about the related crop. The content in this component is updated frequently on the basis of recent technological advancements.

b. Decision Support System (DSS)

DSS is a computer based decision making system. A decision is a choice between two or more alternatives based on estimates of their values. Supporting a decision entails assisting farmers who are working alone or in a group in gathering information, generating alternatives and making decisions. DSS has therefore been considered and designed to provide farmer with the best possible options and decisions for present agricultural operations. DSS consists of information about season, variety, soil, water, land preparation, management of nursery, nutrient, pests and diseases, details about tools and implements, post-harvest ideas, value addition and information about various institutions and schemes.

c. Crop Doctor:

Crop doctor is an important part of expert system which acts a Artificial Intelligence (AI) tool. This component is based on 'if and then rule' programme. It is especially image and picture based system component. The main role of crop doctor is pest and diseases diagnosis along with nutritional disorders which are affecting the crops chosen. In the main visual signs (primary symptom) with several phases, the first visible indication is seen as thumbnail photos with multiple stages (secondary symptoms). By using if and then rule programme, primary and secondary symptoms were documented in stages and loaded into expert system shell. Then, the concerned experts have validated the symptoms and comes out with solution outcome.

Agmarknet

AGMARKNET is a e-network for marketing of agricultural products with a correct and appropriate knowledge about prices and market arrivals by the farmers and trading by stakeholders. It is accessible through internet access. It is a central sector scheme which covers and collects agricultural produce prices information and details about market arrivals on a day-to-day basis. e-Alert is a method of providing information to common public about prices of agricultural produce with the help of e-mail and SMS.

CONCLUSION

The agricultural production system has developed into a complex business system, requiring expertise and information from many sources to be collected and incorporated. In order to stay competitive, modern farmers often rely on agricultural specialists and advisors for knowledge and decision making. Unfortunately, when the farmers want it, assistance with agricultural knowledge is not always available. Farmers should

begin using ICT tools, especially mobile based apps, portals and expert systems to address this issue. As the number of apps continue to increase it is important to be selective in choosing the app, review and ensure that the App provides credible and current information and meets requirements.As farmers are slowly moving towards Personal Digital Assistance (PDA) based mobile applications. Hence, it is appropriate and efforts and initiatives needs to focused on realistic Artificial Intelligence (AI) based application on real time is the order of day. It may overcome the general recommendations and advisories which provided by the extension wing into farm specific and crop specific advisories.

As we know, during this COVID-19 pandemic situation, lots of economic crisis were faced by farmers especially due to poor marketing facilities and channels. Farmers were unable to sell their agricultural produce in the market for better price. Due to this situation, farmers faced the loss and they were not got benefited by practicing agriculture. One of the reasons for this situation is that farmers are mostly relies on middlemen and traders for their business transactions. Farmers were not known fully about the importance and usage of ICT based tools especially mobile applications and e-portals. Through mobile apps and portals, farmers can able to know the market price information through market intelligence, so that they can do their business transactions on their own without relying on any other stakeholders or middlemen. Therefore, farmers need to start using mobile based apps and portals to promote their knowledge and skills through mobile which is available in their own hands. Through the attainment of knowledge by farmers with the help of ICT tools, they can increase their standard of living and can lead a prosperous life at any circumstances in various times of life.

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