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A Review on Impact of Mobile Apps in Agriculture

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ABSTRACT: Currently, e-learning is being used more frequently to enhance information and communication processes, such as in e-agriculture, in order to improve agricultural and rural development. The steps of conception, design, development, analysis, and implementation are used to generate new ideas. The purpose of this mini review was to investigate the lack of knowledge and the laborious nature of farming practises to make it possible for farmers to exchange thoughts, findings, tips, and resources linked to e-agriculture and to make sure that the knowledge produced is widely and successfully utilised. One of the main causes of the farmers' difficulties has been the infrequency with which they have been provided with timely and sufficient information on many different kinds of affecting factors, including soil conditions, rainfall, and weather. In a similar vein, most farmers lack access to a communications network that offers real-time updates on market trends and other issues. This article examines how mobile applications might hasten and simplify the development of agriculture. With a variety of mobile applications, many farmers may quickly pick up new techniques for boosting crop yields and enhancing other agricultural output. It has some limitations, particularly in remote areas with slow internet connections, and a daily updated mobile version is released. However, it is clear that technology provides much better advantages in most cases. We have elaborated on various agricultural mobile applications that can potentially be used in farming and related activities, as indicated by their source and usage. In this connection, we can say that farmers can easily access information for the smooth running of agricultural works as well as for the improvement of agricultural, horticultural, and allied sector productivity. By the help of mobile apps, farmers will also not depend on other agencies those are selling their agricultural input with higher rate and low quality. So, mobile apps are the major parts of agriculture in developing countries.

Keywords: E-Agriculture, Mobile apps, Impact of Mobile apps.

INTRODUCTION

Since the term "e-agriculture" is still quite new, we fully expect that it will evolve as our understanding of the industry grows. The goal of the emerging field of "e-agriculture" is to enhance information and communication infrastructure in order to progress agricultural and rural development. The key steps of the agricultural industry are crop growing, water management, fertiliser application, pest control, harvesting, food transfer, safety and quality management, and marketing. Each and every system used to gather knowledge and information for drawing conclusions in any field should provide accurate, comprehensive, and concise information promptly. The system's output must be usable, simple to use, reasonably priced, and adequately protected from unauthorised access. To make it possible for locals to share knowledge about e-agriculture, including resources, ideas, and insights, and to make sure the knowledge gathered is consistently and widely. According to the Food and Agricultural Organization of the United Nations (FAO, 2005), The term "e-Agriculture," which refers to farming, knowledge transfer, and answers provided or augmented through the Internet and modern devices, is a developing field at the convergence of agricultural analytics, agricultural productivity, and entrepreneurship. In more detail, it includes the conception, design, creation, testing, and implementation of fresh (new) approaches to the use of current or developing information and communication technologies (ICTs).

The majority of farmers have access to a number of information sources that they check frequently for agricultural information, even though these are not always the most current, reliable, or helpful sources. The most popular information sources continue to be the media (TV, radio, newspapers), other farmers,

government agricultural extension agencies, businessmen, small traders, seed organizations, and families. The accuracy and usefulness of the information offered by various sources can, however, be very inconsistent. Certain information sources, like the middleman, who also acts as a moneylender, may even be prejudiced against the farmer. Thus, most farmers lack access to trustworthy, consistent information for many of their needs, which prevents them from making decisions. A further restriction is that, even when reliable and up-to-date market price data is readily accessible, farmers usually fail to take advantage of any conceivable pricing opportunities that may exist between marketplaces because they are unable to move their produce to the markets with higher prices (Okediran and Ganiyu 2019). In this regard, the development of mobile communication technology is bringing about a variety of chances for grassroots innovation and social empowerment in developing nations. The contribution of mobile applications to Agriculture and Rural Development (ARD), which gives rural residents access to information, markets, and services, is one of the areas with possible effects (World Bank, 2012).

A smartphone app is one platform where a farmer can get all the information and answers they require with just one swipe. Farmers' connectivity has shifted as a result of receiving agri-information via smartphone apps. Two billion people used smartphones worldwide in 2016, according to statistics (EMarketer, 2016). Moreover, data shows that India, with 167.9 million smartphone users in 2015, is the third-largest smartphone user base after China and the United States (EMarketer, 2016). For the past few decades, villagers, extension workers, scientists, subject-matter experts at Krishi Vigyan Kendrs, universities, etc. have done the majority of the information and technology transfers related to agriculture. Since the invention of the internet, most information has been sought using a web-based method (e-based services). Unfortunately, only a tiny number of individuals have access to it because computer equipment installation is so expensive. The term "mobile app" refers to software programmes designed specifically for use on portable electronic devices like smartphones and tablets. These apps were initially developed to replace computer programmes. They have now spread to a number of sectors, including business, gaming, banking, and information services. Compared to other industries, the need for mobile applications in the agriculture sector is now modest, but it is growing. In the same context, a wide range of activities are available as mobile apps in the mobile app stores, from the land (seed to seed cultivation, weather forecasting (Romani *et al*., 2015), land preparation, nursery management, fertiliser calculations, pest and disease diagnostics, dairy farming (Gichamba and Lukandu 2012), harvesting techniques, management of crop sensors (Lomotey and Deters 2014). Because they are less expensive and easier to integrate with different cellular services, mobile-based applications are on the verge of replacing computer-based services. Smartphone's, internet service providers, and application developers are all part of the mobile-based revolution as a whole. Users were drawn to smart phones with cutting-edge features like high-resolution cameras, more memory, bright displays, touch screens, and 3G, 4G, and 5 G speed internets.

Digital agriculture, sometimes known as smart farming or e-agriculture. The Committee on Doubling Farmers' Income (DFI) in its report has appreciated the role of Digital Technology, which can play a transformational role in modernizing and organizing how rural India performs its agricultural activities. Digital technologies are finding increasing use in the agricultural value system, and farmers are increasingly becoming more informed, as various measures are taken to provide them ready access to technology and information (Ministry of Agriculture and Farmers Welfare, Govt. of India, Digital Technology in Agriculture, Posted On: 02 AUG 2022 6:03PM by PIB Delhi)

The various app categories used for agriculture, farm-related tasks, and future technology transfer were discussed in this article. It is readily available for no cost download from the Google Play Store or the App Store. There are more numbers of Android-based mobile applications made by different companies, state and central government, research institute, Universities etc. In this connection some of the important Android-based mobile applications are as given below :

PM-KISAN app: Funds are instantly sent into eligible farmers' bank accounts under the PM KISAN Scheme's Direct Benefit Transfer mechanism. With the Farmers Corner of the site, farmers can self-register. To increase the program's accessibility, the PM-KISAN Mobile App was introduced. Through it, farmers may check the progress of their applications, update or change their names in accordance with their Aadhar cards, and monitor a history of bank account credits. The maximum amount of Rs. 6000/- per annum for cultivation purpose in several state have been received in each and every farmers those have been registered under PM-KISAN scheme. Notably, this Android software has been downloaded and installed by over 5,000,000 individuals, and 49,843 of them have left a 3.8 user rating (PM-KISAN, 2021; Google play store, 2021).

Krishak Bandhu app: With the goal of giving financial support to all West Bengal farmers for agricultural purposes and providing social security to farm families in the event of the farmers' untimely death, the Department of Agriculture, Government of West Bengal, launched the "Krishak Bandhu" Scheme in January 2019. The plan was recently recast and given the new name "Krishak Bandhu (Natun)". On June 17, 2021, the Honorable Chief Minister of West Bengal introduced the new program (Krishak Bandhu, 2021) The West Bengal government established the Krishak Bandhu Program to assist farmers in West Bengal at the pre-production stage and to provide farm families with income protection in the event of a farmer's passing. The maximum amount of Rs. 10000/- per annum for cultivation purpose in West Bengal have been

received in each and every farmers those have been registered under Krishak Bondhu scheme.

Kisan Suvidha Mobile app: In order to make it simpler to inform farmers about important issues like weather, market prices, plant protection, input dealers (seed, pesticide, fertiliser), farm machinery, soil health cards, cold storage & godowns, veterinary centres, and diagnostic labs, Prime Minister Narendra Modi launched the Kisan Suvidha mobile application in 2016. With the aid of market intelligence, farmers are better informed about the markets where they may sell their produce, the current market price, and the market demand. As a result, they can make an informed decision about whether to sell produce at the right time and price. Due to its multilingual capabilities, the software is more broadly accessible (Kishan Subidha, 2016).

mKisan app: With the help of C-DAC Pune, a member of the internal IT group of DAC, built this app. According to TRAI data from May 2014, despite the fact that there are approximately 38 crore mobile phone connections in rural areas, internet penetration in rural areas remains abysmally low (in the single digit percentage). As a result, mobile messaging has proven to be the most effective strategy thus far, reaching over 8.93 crore agricultural families. The mKisan SMS Portal for Farmers enables all Central and State government entities in agriculture and allied sectors to provide farmers with information/services/advice by SMS in their preferred language, agricultural methods, and location (TRAI, 2014).

AGRIMARKET: The State Marketing Boards/Directorates, agricultural markets, and significant national and international organizations are all connected through the Agmarknet portal, which is a government of India portal on agricultural marketing. It is supported by a large area information network. Using the AgriMarket mobile app, users may access market information 50 kilometres away from their device, including the current crop price. This programme automatically locates users and collects the latest crop price in any markets within a 50-kilometer radius using mobile GPS. There is an alternative method to discover the price of any market and any crop if a person does not want to use GPS location (ISAM, 2014).

CROP INFO: Nirantara Livelihood Resources Private Ltd., a company based in Bangalore, Karnataka, created it. The Crop Info App provides commercially important agricultural and horticultural crops' production technology on your smartphone. It provides details about the market, available options for processing, production variables, and technologies for use after harvest. For agricultural and horticultural university students and faculty, subject matter experts and extension officers from the departments of agriculture and horticulture, business professionals, farmers, and anyone else interested in crop cultivation, the Crop Info app was developed specifically for them (https://play.google.com/store/apps/details?id=com.saaranga.cropinfoandhl=enandrdid)

Mahalanobis National Crop Forecast Centre (MNCFC): In the FASAL project of the Ministry of Agriculture, this Android-based app created by National Remote Sensing Centre, ISRO, is helpful for gathering field data for crop assessment utilising satellite data. The application can be used to gather field data such as crop kind, condition, sowing date, soil type, and GPS coordinates as well as field photographs (640 × 480 resolution). As part of crowd sourcing, farmers can also post photos taken using their mobile devices that show the condition of the crops, their types, and the soil. The creation of a national geospatial database of crops will greatly benefit from the information provided. The option to Send Later allows you to send the information later rather than immediately. The ISRO's Bhuvan Server receives all information submitted through this application (www.farmers.gov.in).Centre works in partnership with 19 state agriculture departments, 15 state horticulture departments, 3 ISRO centres (SAC, NRSC, NESAC), 8 ICAR (Indian Council of Agricultural Research) institutes, the India Meteorological Department, the Institute of Economic Growth, State Agricultural Universities, as well as numerous other national and international organizations to carry out these activities. Additionally, the Centre supports the GEOGLAM and Asia RiCE activities (https://ncfc.gov.in/apps.html)

Table 1: Mobile apps developed by Mahalanobis National Crop Forecast Centre.

Sr. No.	Release date	Name of App
1.	05.08.2013	FASAL FDC App
2.	29.09.2014	Crop Cutting Experiment
3.	18.02.2015	FASAL FDC App
4.	08.10.2014	Crop Cutting Experiment
5	12.11.2014	Crop Cutting Experiment
6.	19.02.2015	Crop Cutting Experiment

Source: National Remote Sensing Centre, Indian Space Research Organisation, Hyderabad-500 037 August 2015

Application for poultry: The Ministry of Electronics and Information Technology controls the Indian autonomous scientific society Centre for Development of Advanced Computing (CDAC). Mumbai's Centre for Development of Advanced Computing (CDAC) developed it. Under the Centrally Supported Scheme, the Animal Husbandry Department of Himachal Pradesh has introduced the Backyard Poultry Program, which provides minimal input technology birds of coloured strain yet disease resistant kind to the state's farmers. An applicant can submit an online application for the Poultry Chick and Backyard Poultry Schemes of the Government of Himachal Pradesh using this app (www.farmers.gov.in). The daily selling of eggs aids in boosting agricultural productivity by enabling the purchase of necessary inputs like seed and pesticides. An excellent source of farm manure is poultry waste. The state's farms and hatcheries are being gradually strengthened with the introduction of the Centrally

Sponsored Scheme in order to readily meet the demand of the rural people for chicks of both the egger and broiler strains (CDAC–Mumbai, 2013).

IFFCO Kisan Agriculture App: IFFCO (Indian Farmers' Fertilizer Cooperative Ltd. subsidiary)'s manages Kisan, which was established in 2015. Its objective is to give Indian farmers information that is personalised to their needs so they may make wise decisions. The user has access to a variety of instructional modules throughout the profiling stage, including weather, market price, agricultural advice, and an information library. These modules are available in the user's chosen language and take the form of text, photos, audio files, and videos. Also, the app offers helpline numbers for Kisan Call Center Services (IFFCO, 2016).

Krishi Jagran: This newly released app, Krishi Jagran, offers topical agri news, cultivation instructions, a crop calendar, comprehensive information on crop protection, pest and disease management, subsidies, a career in agriculture, and all the knowledge necessary for farm mechanisation. Farmers may access all crop-related information at their fingertips thanks to this portal. The globe is connected to farmers through this conveniently accessible agri platform, which also gives them access to all pertinent information related to agriculture (M.C. Dominic, 1996).

Agri App: Agri App is a comprehensive app designed with farmers in mind that offers comprehensive information on crop production, crop protection, and all pertinent agriculture-related services. Additionally, it enables farmers to access all the data on crop types, soil/climate, harvesting, and storage practises for the "High value, low produce" category. Also, this app offers a chat feature with specialists, video-based learning, the most recent news, and online markets for fertilisers, pesticides, etc (Criyagen, 2016).

Kheti-Badi: A social initiative app called Kheti-Badi attempts to help and promote "Organic Farming" and provide crucial information about problems affecting Indian farmers. This app assists farmers in making the transition from chemical to organic farming. Sadly, there are presently just four languages available for this software (Hindi, English, Marathi, and Gujarati) (Kumar & Tiwari 2022).

Shetkari: For Indian farmers, there is a multipurpose mobile app called Shetkari Mitra. It offers expertise and information on government programmes, crop management, Agri-Business & Guidelines, market prices, and agricultural success stories. Users of this Android software will get access to magazines via their mobile devices, the internet, or Wi-Fi (mKisan, 2016).

Fertilizer calculator: This app is used to convert the nitrogen, phosphorous, and potassium contents of fertiliser doses. It offers eleven different nutrient dose combinations as fertilisers. Urea-Single super phosphate-Muriate of Potash, Di-Ammonium phosphate-Urea-Muriate of Potash, calcium ammonium nitrate-Single super phosphate-Muriate of Potash, Ammonium phosphate-Urea-Muriate of Potash, etc. are a few examples of combinations (Koti, 2016).

Soil test methods: To prepare for fertiliser management that will produce crops that are both economically successful and environmentally sustainable, soil testing is essential. It has recently taken on a level of significance never before seen, especially in light of the rising awareness of soil health cards in Indian agriculture. In modern agriculture, which not only seeks to increase crop productivity but also to maintain the fertility status of the soil for ongoing crop production, the indiscriminate use of fertilisers based on their general recommendations or without knowledge of the native availability of plant nutrients in soil is of little significance. Additionally, the accuracy of soil testing is a key factor in determining the validity of "soil test-based nutrient recommendations," so it is important to have a thorough understanding of the various soil testing techniques that are frequently used to create soil health cards and formulate nutrient recommendations. We present here the Android-based mobile application "Soil Test Techniques" in the hopes that it will act as an immediate guide to soil testing for you (students, researchers, and soil test employees).

Kisan Yojana: Agricultural News Network (ANN) is the company that created the Kisan Yojana app. As of now, it supports eight Indian states: Maharashtra, Gujarat, Karnataka, Andhra Pradesh, Uttar Pradesh, Bihar, and Jharkhand (accessed on 2 Feb 2016). This app provides information on the policies and services the government offers to farmers and rural residents (ANN, 2016).

RML Farmer- Krishi Mitr: Farmers can use this app to keep up with mandi prices and the newest products, weather forecasts, exact pesticide and fertiliser usage, farmer-related news, agricultural information, and more. Additionally, it offers news about the government's agricultural policies and programmes as well as agricultural tips. It is built with specific tools to look into or provide information on various facets of farming practises (Kumar & Tiwari 2022).

Mobile apps under ICAR: The Indian Council of Agriculture Research (ICAR) has also compiled more than 100 mobile apps developed by ICAR, State Agricultural Universities and Krishi Vigyan Kendras and uploaded on its website. These mobile apps developed in the areas of crops, horticulture, veterinary, dairy, poultry, fisheries, natural resources management and integrated subjects, offer valuable information to the farmers, including package of practices, market prices of various commodities, weather related information, advisory services, etc. (Fig. 1).

Some of popular Mobile apps developed by Indian Council of Agricultural Research, New- Delhi are as follows :

Arka Bagwani app: The ICAR-IIHR, Bengaluru's official app, Arka Bagwani, features all the innovations and studies that are beneficial to farmers. The Arka Bagwani app is now accessible in English, Kannada, and Hindi (www.icar.gov.in).

Groundnut-Integrated Pest Management (IPM) and Groundnut: Integrated Pest Management (IPM) includes technologies, strategies, and practises for the economical management of insects and diseases that

become pests. IPM is a comprehensive approach to plant health management. IPM attempts to keep disease severity and insect population levels below those that would economically harm plants. Growing healthy crops in a secure ecological, environmental, and sustainable environment is a key component of IPM. ((www.icar.gov.in).

Mango Cultivation app: The Indian Institute of Horticultural Research (IIHR), located in Bangalore, is where the smartphone app on mango cultivation was created. For the benefit of farmers and other parties interested in mango farming, this smartphone app has been developed. The application covers all aspects of crop production, including the need for soil and climate, propagation, spacing, planting, training and trimming, INM, irrigation, and harvesting. The pest management modules include fruit fly, mango hopper, stone weevil, mealy bug, shoot borer, stem borer, and other infestations. The crop management aspects include disease management for the various diseases affecting mango crops, including anthracnose, blossom blight, leaf blight, powdery mildew, dieback, etc ((www.icar.gov.in)

Fruit crops: The fruit crops mobile application provides information on the genetic improvement of fruit crops, including mango, papaya, grapes, guava, pomegranate, custard apple, fig, jackfruit, and other underutilised fruits, for increased production, quality, and resistance to biotic and abiotic challenges by using breeding procedures such as hybridization, mutation, backcross method, OP seedling selection, raising of half-siblings, distant hybridization, and haploid breeding (Narwal *et al*., 2022).

Saur Shakti ICAR: SAUR-SHAKTI, a mobile app offered by the ICAR-Research Complex for the Eastern region, is intended only for illustrative purposes and helps farmers, scientists, and development officers choose the right size of the solar pump based on the amount of crop that will be grown, how much water it will use, where it will come from, and the irrigation systems that will be used in the field. The app comes with statistics for the districts of Jharkhand and Bihar. To determine the proper size of the pump, users from other states must supply information on the water table, drawdown, and depth of the open well (Narwal *et al*., 2022).

mKRISHI® Fisheries: The Tata Consultancy Services (TCS) Innovation Lab in Mumbai created the mobile app mKRISHI® Fisheries in association with the Central Marine Fisheries Research Institute of the ICAR and the Indian National Centre for Ocean Information Services (INCOIS) in Hyderabad. This app is the result of extensive fieldwork and study that drew on the greatest talent from each of the partner organisations. Based on sea surface temperature, the abundance of phytoplankton, which serves as food for a number of fish species, and remote sensing data from NOAA satellites, INCOIS provides a potential fishing zone (PFZ) and fish shoal forecast information (Narwal *et al*., 2022).

ICAR IISR Black pepper: The ICAR Black pepper mobile app was created to assist farmers by giving them quick access to pertinent information. They can get information on plant management, horticulture, and other topics with the push of a button (Narwal *et al*., 2022).

Seed Spices Info: National Seed and Spice Research Center (NRCSS). At India's National Agriculture Research System (NARS), Ajmer is the only institution conducting research on seed spices and disseminating its findings to farmers (Narwal *et al*, 2022).

Oil Palm Pests English, Oil Palm Nutrients English and Oil Palm Cultivation English: The signs of pest infestation in oil palm, including the rhinoceros beetle, scales, mealy bugs, slug caterpillars, bag worms, chafer beetles, termites, leaf webworms, birds, rats, and wild animals, were described along with their control methods. The management of oil palm plantations during the juvenile phase and adult plantations, including nitrogen, potassium, phosphorous, boron, magnesium, iron, copper, zinc, and manganese disorders, was explained along with the symptoms of nutrient deficiencies. climate requirements for the development of oil palm in India. Cultivar, season of planting, and density of planting (Narwal *et al*., 2022).

Krishi Gyan: An application called Krishi Gyan (in Hindi) aims to provide farming and rural communities with agricultural information. With the use of this app, Indian farmers will be able to communicate with Krishi Gyan specialists, ask questions about farming, and receive notifications within the app when they have answers. Both farmers and agriculture enthusiasts can exchange answers with one another (Narwal *et al*., 2022).

Kisan Mitra: "Kisan Mitra" Gujarati apps is designed and developed by Navsari Agricultural University to fulfill the need of farmers community in the area of Agriculture, Horticulture, Veterinary. The content is prepared and compiled by Research Scientist Group of Navsari Agricultural University in Gujarati native language (Narwal *et al*., 2022).

Mobile Farm Solutions (Q&A): The goal of the app is to assist farmers in contacting the scientists or SMS experts of KVKs in their local districts with regard to issues with crops, soil, pests, etc. Reports can be sent to the scientist or subject matter expert of KVKs in the form of plain language, such as a brief description of the problem with the crop, as well as by taking a picture of the crop. Farmers who want to utilise this mobile app must first register their name, phone number, and address. It will be approved by the KVK programme coordinator for the relevant district (Narwal *et al*., 2022).

ICAR-MUSHROOM: The primary audience for the ICAR-Mushroom App is our esteemed farming community, specifically mushroom growers, mushroom entrepreneurs, mushroom researchers, and students. Mushrooms are produced inside both seasonally and in climate-controlled cropping rooms. The mushroom may be cultivated on agricultural waste and is a nutritious food that is rich in vitamins and minerals, including vitamin D. Hence, it was thought necessary to create a platform where farmers could access real-time mushroom information in order to popularise

mushroom gardening among the general public. As a result of our ongoing efforts, the current app exists (Narwal *et al.*, 2022).

(Source: www.icar.gov.in)

Fig. 1. Images of mobile apps related on agriculture, horticulture and allied sector developed by Indian Council of Agricultural Research, New- Delhi.

CONCLUSIONS

The majority of the population in our nation works in agriculture. It is crucial that agriculture be connected to modern technologies in order to make it efficient, easy, and respectable. E-agriculture or smartphone applications are changing agriculture today. This technology makes it possible to learn new approaches quickly and directly for boosting crop yields and increasing productivity in agriculture. In the case of the information collection through mobile apps, viz., the timely availability of quality input in agriculture, we can say that farmers will not depend on various agencies having a higher rate for selling low-quality seed, fertilisers, pesticides, agricultural implements, etc. The techniques for increasing application-based information demand the removal of barriers such as better modest handsets, compatible smart phones, multilingual platforms, subsidised internet packs, regular trainings, and farmer awareness. Every system has its own setbacks. Nonetheless, it is evident that technology generally offers considerably superior benefits. Yet by providing farmers with access to better platforms and training them on how to overcome them, we can close the gap between these drawbacks.

FUTURE SCOPE

Having a decision support system based on mobile applications and regional data, which provides specific geographic data based on soil and water conditions and microclimatic patterns throughout the planting season, would be extremely beneficial for Indian farmers. To explore new frontiers, mobile technologies can be

seamlessly incorporated with contemporary farm machines.

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