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Information Technology Emergence in Agriculture during COVID-19

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ABSTRACT

In addition to land, labour and money, knowledge is crucial in agricultural production. Recent IT advances have allowed the industry to increase operating performance, reduce costs, reduce waste and improve the quality of its production. This chapter addresses aspects that incorporate information technology into the farming environment, such as e-agriculture, IoT, social media, mobile apps, etc., to boost farmers. The latest IT innovations that encourage successful IT penetration in rural India, the changing pattern of knowledge requirements and the role of IT in agricultural production.

Keywords: *Agriculture, Farmer, Information, Mobile, Technology.*

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INTRODUCTION

In the background of a rapidly growing population, agriculture is the world's most important industry. Regulation and optimization of technical innovation in agriculture needs can really contribute to saving environmental capital, upholding business and international rules, fulfilling customer needs, and pursuing economic gains [1]. Improving food quality and boosting productivity without unnecessary and redundant manual work is one of the biggest challenges in agriculture. Mobile technology definitely allows inputs to be used efficiently and decreases labour demand, contributing to improved efficiency in output [2]. Ensuring that new technologies help farmers become more economically competitive is the main challenge for hi-tech agriculture [3].

The COVID-19 crisis has shown how digital technologies can contribute to supply chains running smoother and more effectively. Farmers use multiple information sources that can harmonise or substitute them, and single information sources often do not meet the needs of farmers [4]. To support food chains, it is possible to foresee problems and manage temporary shortages. New technologies could promote the supply-demand interface, which would be particularly useful for the supply chains of highly perishable products. When harvesting and selling their crops, horticultural farmers have faced greater problems than other farmers. Policies should promote and encourage mobile procurement of perishable products through the National Agricultural Cooperative Marketing Federation of India (NAFED), farm producer companies (FPCs), companies and other aggregators involved in structured value chains. Holding IT tools in the light of the COVID-19 guidelines and maintaining social distance is important for the exchange of knowledge in the agricultural sector and the digital provision of support to farmers when necessary. Most of the extension activities were effectively carried out by rural-level functionaries with mobile resources such as Whatsapp, Youtube , Facebook, etc. In the online mode, various training programmes, seminars , conferences, workshops were conducted using web conferencing platforms such as Zoom, Google Meet, etc. Information technology offers ample opportunities for zero-contact social distancing during the COVID 19 timeframe to organise agricultural activities.

E-agriculture

India is a developing country among world nations in which only urban and semi-urban people have enjoyed web-based connectivity and its various advantages. E-agribusiness represents an increasing sector focused on upgrading agriculture and its products and advancing the country through enhanced data and correspondence forms. With an important emphasis on horticulture, e-farming involves the conceptualization, outline creation, evaluation and use of inventive approaches to the use of data and correspondence technologies in rustic space. In 2008, the United Nations launched e-horticulture as a "increasing field" with the desire to transform and grow rural areas by expanding it. The e-agribusiness strategy provides a framework for more competently addressing ICT openings and difficulties in the horticultural sector in a systematic manner while creating new income streams and developing the country network's occupations and also ensuring that the goals of the national end-all agricultural strategy are achieved. The presence of the e-horticulture technique and its agreement with other government designs will prevent the disengagement of e-farming tasks and administrations from being updated. The Food and Agriculture Organization and the International Telecommunication Union developed an e-horticulture strategy guide with the aid of accomplices, including the Technical Center for Agricultural and Rural Cooperation, as a system for nations to improve their national e-agribusiness tactics / end-all policies.

Kisan Credit Card (KCC)

A payment system launched by Indian banks in August 1998 is the Kisan Credit Card system. The National Bank for Agriculture and Rural Development prepared this model scheme on the basis of the recommendations of the R.V.GUPTA Committee on the provision of term loans and agricultural needs. Its mission is to meet the agricultural sector's comprehensive credit requirements by providing farmers with financial support. Commercial banks, regional rural banks, and state cooperative banks are among the participating institutions. There are short-term credit caps for crops and term loans under the system. Under personal accident insurance, KCC credit holders are insured up to Rs. 50000 for death and permanent disability and up to 25000 for other risks. The premium is paid in a 2:1 ratio by both the bank and the borrower. The term of validity shall be five years, with the option of being extended for up to three additional years. Kisan Credit Card provides farmers with two forms of credit, cash credit and term credit for allied activities such as pump sets, soil production, plantation, and drip irrigation.

Robotics in agriculture

The use of robotics in agriculture is increasingly becoming a high-tech industry that is thought-provoking, serving novel experts, original companies and new investors. Technology is evolving rapidly, not only advancing farmers' manufacturing capacities, but also advancing the knowledge of robotics and mechanisation as we know it. The multipart ranch duties in the agricultural sector are too dangerous and are done by robots, which are difficult for humans to accomplish. Latest news alleges that the Japanese regime has implemented a plan to use in-domain automated operators inundated by the tsunami of March 2011. This "Dream project" was planned to involve efficient unmanned tractors at the disaster site on the farm. Robotic farmers are able to grow vegetables , fruits, soybeans, wheat and rice, which are then packed in boxes and transported by this robotic technology throughout the world. Agricultural robots are growing manufacturing yields for farmers of different ethnicities. The technology is used in original and groundbreaking applications, from drones to self-governing tractors to robotic arms.

IoT in Agriculture

A device to track the crop field with the aid of sensors (light, humidity, temperature, soil moisture, etc.) and to automate the irrigation system is built on IoT-based smart farming. Farmers from anywhere can track the field conditions. When compared to the traditional method, IoT-based smart farming is highly effective. We can track the crop from anywhere with the aid of technology and we can provide water to field from a remote location, crop detection can also be achieved without being on the ground.

In addition to targeting traditional, large-scale farming operations, IoT-based smart farming applications may also be new levers to uplift other growing or popular agricultural trends, such as organic farming, family farming (complex or small spaces, specific cattle and/or crops, preservation of specific or high-quality varieties, etc.), and to enhance highly transparent farming. Smart farming based on IoT can have great advantages, including more effective use of water or optimization of inputs and treatments. Based on big data analytics, cost management techniques can be developed that could be suggested by mobile technology and its smartphones and other smart agri-devices as an integral part of the large-scale agricultural sector [5]. The key fields of IoT application in agriculture are-

1. **Precision Farming:** Precision farming can be considered as something that, when it comes to growing crops and raising livestock, makes farming practise more regulated and precise. The use of IT and various products such as sensors, control systems, robotics, autonomous vehicles, automated hardware, variable rate technology, etc. are a key component in this method of farm practises. A few

main developments characterising the precision agriculture trend are the adoption by the manufacturer of connectivity to high-speed internet, mobile devices, and reliable, low-cost satellites (for imagery and positioning). Precision farming is one of the most popular IoT applications in the agricultural field, and many organisations around the world are exploiting this technique.

2. **Agricultural Drones:** Over time, technology has advanced and agricultural drones are a very strong instance of this. Today, agriculture is one of the key industries for drone incorporation. Drones are used for agriculture in order to optimise various agricultural activities. The ways in which ground-based and aerial-based drones are used in agriculture are crop health assessment, irrigation, crop inspection, crop spraying, planting, and soil and field analysis. The major advantages of using drones are crop health imaging, interactive GIS mapping, ease of use, time savings, and the potential to increase yields. With strategy and planning based on real-time data collection and processing, drone technology will give a high-tech makeover to the agriculture industry. We can draw insights from the drone data on plant health indices, plant counting and yield prediction, plant height measurement, canopy cover mapping, field water ponding mapping, scouting reports, inventory measurement, measurement of chlorophyll, wheat nitrogen content, drainage mapping, mapping of weed strain, etc. The drone collects multispectral, thermal, and visual imagery throughout the flight and then lands at the same location where it took off.
3. **Smart Greenhouses:** Greenhouse farming is a technique that helps to increase the quality of vegetables, fruits, grains, etc. The environmental parameters are regulated by greenhouses through manual intervention or a proportional control mechanism. These approaches are less efficient as manual interference results in loss of productivity, energy loss, and labour costs. With the assistance of IoT, a smart greenhouse can be designed; this design intelligently monitors and climate controls, removing the need for manual intervention. Different sensors that calculate environmental parameters according to plant requirements are used to monitor the environment in a smart greenhouse. For remote access to the device when it is connected using IoT, a cloud server can be built. It eliminates the need for constant manual surveillance. The cloud server also allows data processing within the greenhouse and applies a control measure. For farmers with minimal manual interference, this design offers cost-effective and optimal solutions. In the greenhouse, IoT sensors provide information on light, pressure, humidity, and temperature levels. The actuators can be automatically operated by these sensors to open a window, switch on lights, control a heater, switch on a mister or switch on a fan, all operated by a WiFi signal.
4. **Livestock Monitoring:** Large farm owners can collect data about the location, well-being, and health of their cattle using wireless IoT applications. This data allows them to recognise sick animals so that they can be isolated from the herd and thereby avoid the spread of disease. As farmers can locate their cattle with the aid of IoT-based sensors, it also lowers labour costs.

IoT agricultural applications make it possible to collect useful data for farmers. The potential of the IoT market for agriculture must be understood by large landowners and small farmers through the installation of smart technologies to increase competitiveness and sustainability in their production.

5. Social Media

Social media are web-based transmission tools that allow users to communicate individually or in groups with others for the needs of knowledge exchange, sharing thoughts and opinions, influencing and promoting decision-making through producing, storing , retrieving and exchanging information in any form (text, pictures, video, etc.) through anyone in the virtual world [6]. Social networking is described by Merriam-Webster as a type of transmission through which users can build online communities to exchange data, ideas, personal messages and other content. Social media refers to the modern Internet-based tools for sharing and discussing information between individuals. This refers to data, opinion, video, audio, and multimedia created by the user that is exchanged and discussed over digital networks [7]. Fast access through cell phones, mass-personal communication and mass-self communication, a wider collection of weak links to confirm the reception of new ideas, a high degree of accessibility, and the ability to link and exchange content through multiple channels [8] are aspects of social media that provide them with a critical and open tool in communication growth.

Use of Social Media in Agriculture

Facebook: An online media service for social networking. Anyone can post updates on their farm activities, share photos, and see what they are up to with families, celebrities, organizations, and groups. The Facebook group also consists of people known in real life. Facebook helps us to share something that can be seen by friends and people connected to them in the timeline. It has functions for adding friends relevant to your field of work. Several agricultural organizations' Facebook pages are functional, such as SAUs, research centres, NGOs, etc., which regularly post updates on their pages to uplift farmers. Via their profile, these organizations can share photos , videos and other information with farmers.

Youtube: One of the subsidiaries of Google allows users to view videos on the website, like, comment, share, subscribe, upload, report. YouTube has become quite a popular forum on scientific knowledge in agriculture. The contents in youtube are created and uploaded by individuals, media , music, institutions etc. News outlets, agricultural research institutes and non-government organisations are organisational sources for uploading videos. Knowledge in Hindi, as well as in other regional Indian languages, is available.

Whatsapp: One of the most commonly used social media platform now a days as almost everyone who are having smartphones are using whatsapp. This messenger is a very effective medium bridging the gap between farmers and researchers as information can be shared both ways directly to the notification of smartphones. Several groups created by scientists, research organizations, extension functionaries including the farmers of the regions for easy transfer of technology and information among them. The information in whatsapp can be accessed by everyone anywhere and anytime.

Twitter: Twitter allows users to create and share content with less than 140 words. Media richness is high as one can share content worldwide through internet.

Mobile technology

Simple access to knowledge about agriculture and related sectors on mobile devices is the key benefit of mobile apps for farmers. With time to provide support to agriculture and allied sectors, the number of mobile applications is growing for the benefit of farmers with the latest technology and knowledge. A mobile application is a mobile phone or tablet software that allows users to access specific information, to make payments and transactions, to send messages, etc. You can download an application free of charge or pay from any online store, such as Google Play Store, Apple App Store, Samsung Galaxy Apps, LG SmartWorld, Sony Apps, Amazon Appstore, etc., via wireless connectivity on internet-connected devices (mobiles / tablets). In human interface and connectivity, smartphones and mobiles have become an omnipotent system and become a supreme instrument for grassroot agricultural extension linkage. Extension functionaries from Grassroots, viz. Agri-input distributors should be equipped to use smartphones and applications with progressive ICT software [9]. There are many mobile apps used by farmers to fulfil their data needs, which are**:**

1. **Kisan Suvidha:** Kisan Suvida was developed by the Ministry of Agriculture and Farmers Welfare for farmers in facilitating dissemination of data on Market Prices, Agro-advisory, Weather, Extreme Weather Alerts, Plant Protection, Dealers – Fertilizer, Seed, Farm Machinery, Pesticide, animal husbandry, crop insurance, Call to Kisan Call.
2. **IFFCO Kisan Agriculture App:** The farmers can access a range of instructive modules which includes weather, agricultural advisory and agriculture information library within the style of text, market prices, audio, videos and images with the selected language of farmers. The application also provides helpline numbers to induce connection with Kisan center Services.
3. **RML Farmer (Krishi Mitr):** RML Farmer may be a one kind of agriculture application where farmers can carry on with the newest product and market prices, accurate usage of fertilizers and pesticides, weather outlook and advisory, farm and farmer related news. It also provides agricultural guidance and news concerning the government's agricultural policies and schemes.
4. **Pusa Krishi:** It aims to assist farmers to get information regarding technologies developed by Indian Agriculture Research Institute (IARI), assisting the farmers to receive increased return.
5. **AgriApp:** AgriApp supplies whole information on crop cultivation, crop protection and each one related agriculture allied services. It too enables farmers to avail complete knowledge associated with "High value, low product" kind of crops from varieties, soil/ climate, to harvest and storage measures.
6. **Kheti-badi:** 'Kheti-Badi' may be a social proposal application. It assists to push and help 'Organic Farming' and give relevant information/issues associated with farmers in India. Agriculture now-a-days is highly infatuated with genetically modified seeds, fertilizers and chemical pesticides; this application assists farmers towards switching their chemical farming into organic farming. However, this application at present is only available in three languages (Hindi, English and Marathi).
7. **Whatsapp:** It should come off as a surprise to many, but one in every of the foremost widely used app for texting is bridging gaps between farmers. Departments of Agriculture at some states have utilised this public podium to form several groups with progressive farmers who connects them through their Smartphones. It originally started with groups of officials with android phones and later it was introduced to agricultural communities with large number of farmers involved with it.
8. **Krishi Gyan:** Works on the identical aspect as Whatsapp communication but is taken into consideration to be better because it doesn't require mobile numbers of individuals to stay connected. Aside from supplying common information on farming, it enables Indian farmers to attach with Krishi Gyan experts and enquire questions associated with farming, and search answers inside the applying

through notifications. The farmers in addition as agriculture enthusiasts can still share their answer among each other.

9. **Crop Insurance:** The application assists farmers to analyse premium for notified crops and provides information points in time and company contacts for his or her crop and site. It can also be accustomed to get particulars of regular sum insured, premium details, extended sum insured and subsidy information of any notified crop in any notified area. It's further linked to its web portal which caters to all or any or any stakeholders including farmers, states, insurance companies and banks.
10. **AgriMarket:** It was launched alongside the Crop Insurance application by the Government of India, the application was developed with an intend to remain farmers on top of things crop prices and dispirit them to travel for distress sales. Farmers can acquire information linked to values of crops in markets inside 50km of their own smartphone location with the AgriMarket Mobile Application.

Other apps like Agronote, Crop Nutrient Advisor, CropRecords, etc. can be able to easily solve the problems of farmers and assist them to be acquainted with novel technologies developed at research stations.

MOOCs

Massive Open Online Courses (MOOCs) rose to prominence on the promise of increasing access to education for learners from all backgrounds, like the open and distance learning systems that came before them [6]. The shimmering hope is that free courses will bring the world's best education to the planet's most distant corners [9]. The MOOCs played an important role as a source of information during the COVID-19 lockdowns to increase the level of awareness of agricultural practitioners, students as well as farmers. The examples of some MOOCs exchanging information through pre-recorded videos, documents, photos are agMOOCs, SWAYAM, Courseware. AgMOOCs are very commonly used in India by the farming community. AgMOOC courses include Agricultural Value Chain Management; Nutrition, Therapeutics and Health; ICT Basics; Ag-Essentials and Applications GIS; Agricultural and Agro-advisory Weather Forecast; Agricultural Entrepreneurship Growth Basics; Integrated Disease Management; Integrated Pest Management; Agricultural Implementation Concept Thinking, etc. Course materials for some courses that help farmers are also developed in English and Hindi [10].

Virtual Meeting

The COVID-19 pandemic changed the scenario of meetings of normal nature into virtual video conferencing meetings. Meetings, training programmes, seminars, workshops, conferences, etc. are now being conducted online with different tools available for free in the internet. The people can access to these platforms with apps in smart phones which assists in covering a vast mass of people to participate in. Institutions use these platforms for conducting training programmes for farmers, students, extension functionaries for enriching the knowledge of participants. Examples of the online meeting platforms are Zoom Meeting, Cisco WebEx Meetings, Google Meet, GoToMeeting, etc. Farmers having smart phones benefit with meetings conducted by grass-root extension personnel. Network connectivity acts as a barrier for these platforms proper function at few rural areas [11].

CONCLUSION

One of the most important developments in the agricultural sector is the digitalization of agriculture. A fundamental factor in the use of IT in agriculture is definitely the use of mobile technology as an integral part of the digitalization process and the smart farming concept. Most farmers now use mobile phones with internet and social media apps on them. The techniques are used by farmers for creative methods, knowledge exchange, etc. In agriculture, information technology supports advantages such as increased profitability, increased product quality, high pay, increased productivity, increased benefit, easy assembly of information on climate, dampness, soil type, crop design, and can easily exchange agrarian information. The agricultural industry would have to introduce new technology to obtain a much-needed advantage in order to fulfil the needs of the increasing population. In smart farming and precision farming, new agricultural applications through information technology would allow the industry to increase operational productivity, reduce costs, reduce waste and improve the quality of its yield.

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