"Role of ICT Initiatives in Indian Agriculture- An Overview"

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Abstract: Information and communication technology (ICT) in agriculture also known as **e-agriculture**, focuses on the enhancement of agricultural and rural development through improved information and communication processes. e-agriculture involves the conceptualization, design, development, evaluation, and application of innovative ways to use information and communication technologies (ICTs) in the rural domain, with a primary focus on agriculture. ICT includes devices, networks, mobiles, services, and applications; these range from innovative Internet-era technologies and sensors to other pre-existing aids such as fixed telephones, televisions, radios, and satellites. Agriculture is the primary source of livelihood for about 58% of India's population. The share of agriculture in GDP increased to 19.9 percent in 2020-21 from 17.8 percent in 2019-20 according to the Economic Survey 2020-2021. To get the desired results from the use of ICT initiatives for dissemination of information in a country where the majority of the farmers are illiterate, landholdings are small or marginal, the level of infrastructure development is very poor in the rural areas, there is a need to assess the information requirement of the farmers. This research paper presents an overview of the Role of ICT initiatives in Indian agriculture. The research paper also shows that: (i) the Role of ICT in Agriculture, (ii) the Informational Needs of Farmers, (iii) a Review of some of the ICT initiatives made under the Government, cooperative and private sectors, and (iv) Upcoming advanced technology in aid of agriculture and farmers.

Keywords: Information and communication technology (ICT), Initiatives, Agriculture.

INTRODUCTION

Information and Communication Technologies (ICTs) is a broader term for Information Technology (IT), which refers to all communication technologies, including the internet, wireless networks, cell phones, computers, software, middleware, video-conferencing, social networking, and other media applications and services enabling users to access, retrieve, store, transmit, and manipulate information in a digital form.

In India, around 70% of the populace procures its vocation from agriculture. As per the evaluation in 2011, 68.9 percent (83.3 Crore) populace is as yet provincial. The agricultural area is the greater part of the result of the Indian economy. The portion of horticulture in the total national output (GDP) has arrived at right around 20% without precedent for the most recent 17 years, making it the sole splendid spot in GDP execution during 2020-21, as per the Economic Study 2020-21.

ROLE OF ICT IN AGRICULTURE

ICT in Agriculture is an arising field zeroing in on the upgrade of farming and rustic advancement in India. It includes the use of creative ways of involving ICT in the provincial area. It can give precise data important to the ranchers who work in agriculture.

Through ICT, ranchers have been engaged to trade their perspectives, encounters, and thoughts. It has given ranchers more openness and permitted them to utilize science that glances at farming according to a coordinated point of view. Accessibility of convenient data and innovation has been demonstrated extremely critical in regions like infection predominance and dry spells the board subsequently helped the ranchers in staying away from crop misfortune as well as obstructing monetary misfortune, this raised the interest in arranging and making methodologies that could furnish ranchers with different data privileges from planting seeds to the gathering. Also, ICT has now turned into a solid instrument for working on the amount and nature of farming creation.
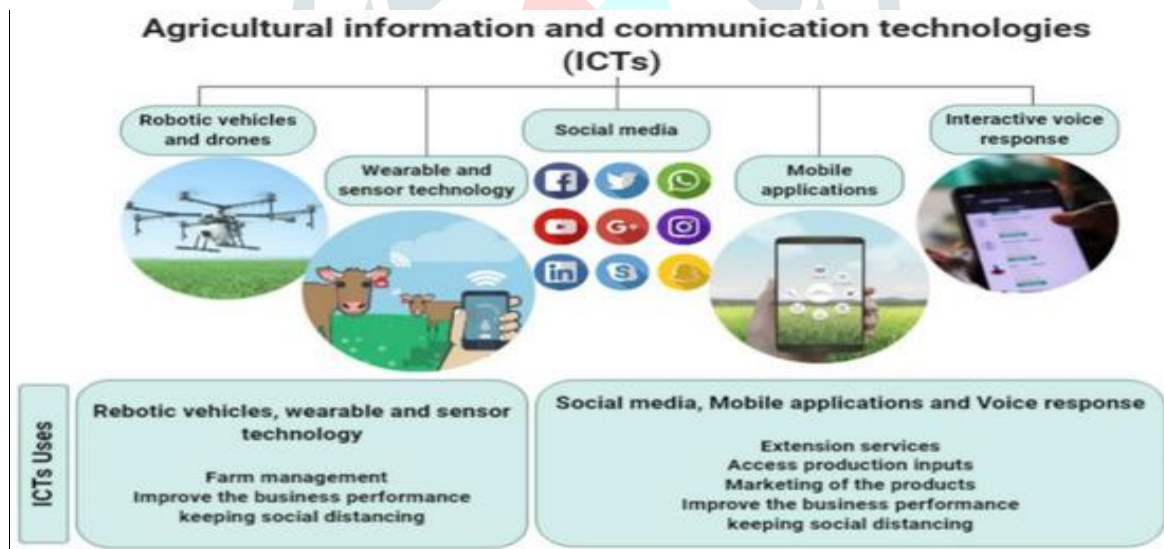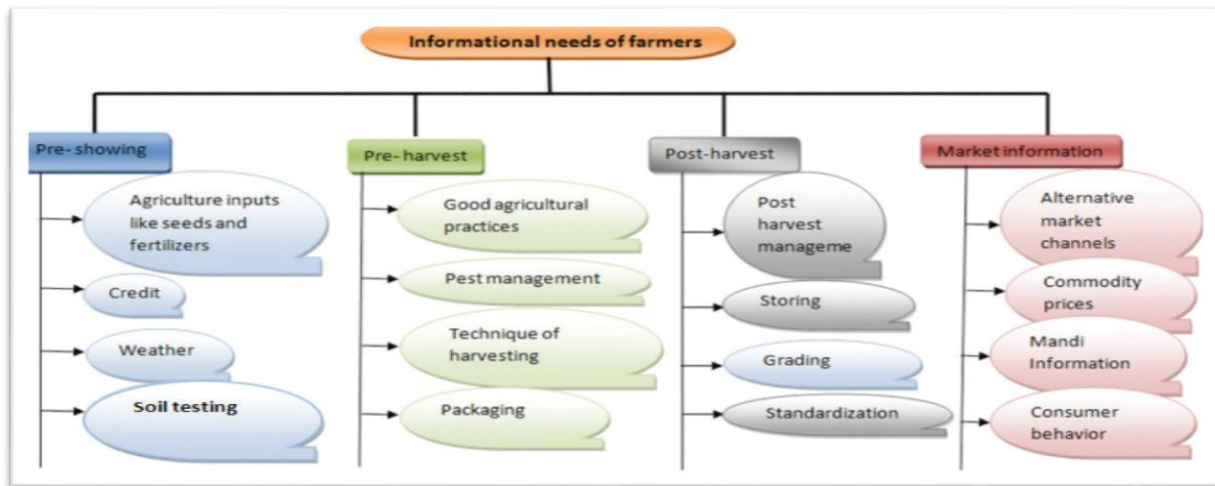

(Fig-1 Role of ICT in Agriculture)

INFORMATIONAL NEEDS OF FARMERS

Admittance to dependable, opportune, and applicable data can help essentially and in numerous ways to lessen ranchers' dangers and vulnerability, enabling them to use sound judgment. Be that as it may, whether this entrance prompts an effect frequently depends on issues connected with business sectors, organizations, approaches, and asset accessibility. A few investigations have shown that the wide accessibility and various wellsprings of data have not altogether changed ranchers' way of behaving toward innovations and the data a reality that is frequently credited to an absence of information or comprehension of ranchers' viewpoints and

requirements concerning data suppliers. The informational needs of farmers are summarized below (fig.2)

(Fig-2 Informational needs of farmers)

REVIEW OF LITERATURE

Jangra, and Mukesh (2018), studied the "Role of Information Technology in Agriculture". Agriculturists and government officials working for agricultural improvement should be capable of making efficient use of ICT to handle new situations which may arise by the whole or incomplete deregulation of the agricultural market, decline of protective events of govt, opening of agriproduct market, up and down in the agricultural environment and use export opportunities.

Gulati et al (2018) have undertaken a comprehensive review of the agricultural extension systems in India. They have reviewed the Indian agriculture extension system at the national level and in six selected states to see how agricultural research, education, and extension contribute to the growth of agriculture GDP. They state that ICT has a significant potential to reach a large number of farmers cost-effectively and it can also facilitate 2way information between farmers and different extension agencies. They also list some examples of ICT initiatives in extension like Kisan, Kisan Call Centre, Kisan TV, community radio, and private sector initiatives like e-choupal.

Singh et al (2017) have reviewed the role of ICT in agriculture in India. They consider the role of ICT in a Decision Support System for agriculture to widen market access and strengthen and empower the farming community. They find that the ICT initiatives in India are primarily focused on the dissemination of information. They suggest data mining, simulation, and modeling, applying cognitive technologies, imaging, and image processing in agriculture to add depth and width to the efforts and get closer to the needs of the farmers. They conclude that ICT has revolutionized potential in the field of agriculture.

Matto, and Asra (2015), studied that Information Technology is the buzz technology nowadays and is helping to exchange information in a fast and easier way at the right time. Information Technology is taking the lead in all the agricultural activities of a nation and has transformed the whole world into a global village with a global economy. Information technology has helped an average Indian farmer to get relevant information regarding agro-inputs, market support, management of farms, agribusiness, agro finance, crop production technologies, and agro-processing.

Gummagolmath, K.C (2011), studied the "Role of ICT in the dissemination of knowledge in the agriculture sector - its efficacy and scope". There is a great transformation in Indian agriculture owing to changes in the economic and trade environment. To cope with these changes timely, relevant, and accurate information to the farmers and other stakeholders will help them make optimum decisions. ICT should play a vital role in the efficient delivery of this information. Several ICT-based initiatives have been tried by different players and the same are analyzed in the present paper.

USAID, (2010), The application of Information and Communication Technology (ICT) can play a pivotal role inefficient dissemination of information. ICT can deliver fast, reliable, and accurate information in a user-friendly manner for practical utilization by the end user. The information disseminated facilitates the farmers to decide what and when to plan, how to cultivate, when and how to harvest, what post-harvest management practices to follow, when and where to market the produce, etc.

CATEGORISATION OF ICT INITIATIVES IN INDIAN AGRICULTURE

Ownership/ Delivery Mechanism	Government	Non-Government	Cooperative/ Private/ Consortium
Web-based	AGRISNET, Krishi, AGMARKNET, DACNET, ATICS, ASHA	-	Pravara, Akashganga, iKisan, Aaqua, Mahindra Kisan Mitra, Haryali Kisan Bazar
Sanchalak (facilitator between the user and service provider)	-	-	Warana, eSagu, iKisan, e-Choupal
Mobile/ Mixed Approach	KCC, Earik, Digital Mandi, e-Agri Kiosk	Fisher Friend Mobile Advisory, Digital Green, MSSRF FEMA	IKSL, Reuters, Market Light

DIFFERENT ICT INITIATIVES IN INDIAN AGRICULTURE

Initiatives	Descriptions
AGRISNET	AGMARNET envisages the promotion of e-Governance by the use of Information & Communication Technology (ICT). It is provided IT-enabled services to the farmers at the block level and also for the computerization of various offices in the states in agriculture & allied sectors.

E Krishi	Implemented by Kerala State IT Mission, the e-Krishi project aims at facilitating and enabling farmers and other stakeholders through IT-enabled Agri-Business Centres to interact with agricultural service providers. The initiative has many services available including marketing agricultural products – both selling and buying, access to warehouses, access to schemes and subsidies, grading of agricultural produce, access to microcredit, and soil testing.
MARKET	Agmarknet portal is a govt. of India portal on agricultural marketing backed by a wide area information network connecting agricultural markets, State Marketing boards/Directorates and also providing linkages to the websites of important National and International Organisations.
DACNET	The Department of Agriculture and Cooperation has initiated the project "DACNET" as a Central Sector Scheme. It is an ICT infrastructure and networking of Directorates, Regional Directorates, and their Field Units for Internet and Intranet access with the central project unit. It develops software for strengthening e-Governance solutions.
ARTICLES	The Agricultural Technology Information Centre (ATIC) is a "single window" support system linking the various units of a research institution with intermediary users and end-users (farmers) in decision-making. ATIC provides Diagnostic services for soil and water testing, plant and livestock health, and Supply research products such as seeds and other planting materials, poultry strains, livestock breeds, fish seed, processed products, etc, emerging from the institution for testing and adaptation.
Pravara	The project aims to connect a hundred villages in Ahmednagar to empower the rural population and improve their quality of life. The information on a government scheme, agricultural marketing, healthcare, education, agro-processing, and economic development are disseminated through IT centers established under the project.
Akashganga	The initiative facilitates the timely collection of milk, and proper payments and generates higher income for dairy farmers. The system includes the weight of milk electronically, fat testing, capturing

	unique IDs by the software, and printing of payslips and payment settlements. Computers are being used for very basic activities like a collection of milk and rural masses are comfortable with them and have reposed their confidence in them.
I Kisan	I Kisan is an agricultural portal, a one-stop information resource for the farmer. It provides online, detailed content on crops, crop management techniques, fertilizers & pesticides, and a host of other agriculture-related material. Latest updates on related markets, products, and weather forecasts are also available.
Aaqua	Almost All Questions Answered or **AAQUA** is a Farmer Knowledge Exchange available at aaqua.org. Any farmer or agriculturist can register and post questions and a panel of Agriculture Experts answers questions based on the problem description and photos if any. Contextual information such as geographical location, weather, and season are retrieved automatically and made available to experts.
Mahindra Kisan Mitra	The initiative provides information on daily market prices, weather updates, crop advisories, Agri-related news, etc. The information is also available on other sections such as loans, insurance, Mandi database, cold storage, warehouses, etc. The farmers can also get motivated and take benefit from the success stories of other fellow farmers reported on the website
Haryali Kisan Bazar	HKB has set up centers across different states to provide solutions to a wide range of problems of farmers under one roof including agri-inputs, financial services, farm-output services, and round-the-clock expert advice. The centers provide information on crops, the latest technologies, weather forecasts, market prices, and customized services based on the farmer database maintained under the initiatives.
Warana	It is an initiative focusing on the overall development of the farming community, rather than being specific to agriculture. Hence the farmers could access information not only related to agriculture but also education, health, etc. Farmers could access six web-based applications from the booths which were: employment and agricultural schemes, government procedures, crop information, water supply details, medical facilities, bus, and railway timetables.
E Sagu	**Prague** is a web-based personalized Argo-advisory system that uses IT to solve unscientific agricultural practices. It exploits the

	advances in Information Technology to build a cost-effective agricultural information dissemination system to disseminate expert agriculture knowledge to the farming community to improve crop productivity.
e-Choupal	**e-Choupal** is an initiative of <u>ITC Limited</u>, to link directly with rural <u>farmers</u> via the Internet for the procurement of <u>agricultural</u> and <u>aquaculture</u> products like soybeans, wheat, coffee, and prawns. The program installs computers with Internet access in rural areas of India to offer farmers up-to-date marketing and agricultural information.
KCC	The *Kisan Credit Card* (**KCC**) scheme is a credit scheme that was prepared by NABARD. Its objective is to meet the comprehensive credit requirements of the agriculture sector. Participating institutions include all commercial banks, <u>Regional Rural Banks</u>, and state cooperative banks. The KCC utilizes telecom infrastructure to provide customized information on various aspects of agriculture in the local language using the toll-free number 1800-180-1551.
Erik	An initiative by NABARD and Central Agricultural University. Touch screen kiosk for technology transfer among tribal farmers of Arunachal Pradesh. All-time farmers query resolution and expert consultation mechanism established through computer-based internet and e-mail, web camera, information website, offline CDs, Digital library, TV, radio, and face-to-face personal communication methods.
Digital Mandi	Digital Mandi is an Electronic Trading Platform for Agro Commodities. It is developed as an application for <u>Infothela</u>. Digital Mandi is inspired by the vision of Media Labs Asia's sustainable village through the culturally appropriate use of new technologies. We envisage an application for the Infothela which touches the root of the village economy.
e-Agri Kiosk	Agri Kiosk aims to provide farmers with importantly agriculture-related information in local language(s) and support interaction with the experts and other farmers using modern digital age communication technologies. AgriKiosk seamlessly integrates digitized video, audio, graphics, text, websites and software applications developed to serve the

	needs of the rural population.
Fisher Friend Mobile Advisory	The information relevant to fishermen is provided in the local language through mobile phones. The information covered is wave height, wind speed and direction, potential fishing zones, relevant news, government schemes, and market price.
Digital green	Digital Green is a global development organization that empowers smallholder farmers to lift themselves out of poverty by harnessing the collective power of technology and grassroots-level partnerships. It helps to increase smallholder farmer income by strengthening our digital extension approach and developing complementary solutions.
MSSRF FEMA	The Fisher Friend Mobile Application (FFMA) is a unique, single-window solution for the holistic shore-to-shore needs of the fishing community, providing vulnerable fishermen immediate access to critical, near real-time knowledge and information services on weather, and potential fishing zones, ocean state forecasts, and market-related information. The application is an efficient and effective decision-support tool for the fisher community.
IKSL	IKSL is a joint venture of IFFCO (Indian Farmers Fertilizers Cooperative) and AIRTEL. IKSL provides voice-based agricultural information in regional languages to empower rural farmers. IFFCO is a well-known cooperative society engaged in the production and distribution of chemical Fertilisers and the marketing of agriculture-related products.
Reuters Market Light	Reuters Market Light provides mobile phone-based customized information according to the individual farmer's preferences on crops, markets, and location. The information in the local language in respect of over 440 crops and varieties, more than 1400 markets, and 2800 weather locations are available across 13 states through SMS.

UPCOMING ADVANCED TECHNOLOGY IN AID OF AGRICULTURE AND FARMERS

Advancement is more significant in present-day farming than at any time in recent memory. The business overall is confronting immense difficulties, from increasing expenses of provisions, a lack of work, and changes in buyer inclinations for straightforwardness and supportability. Lately, the reception of advanced innovations in accuracy agribusiness has been changing the manners in which ranchers treat crops and oversee fields. Significant innovation developments in space have zeroed in on regions like GIS programming and GPS agribusiness, Satellite symbolism, Drone and other elevated symbolism, indoor vertical cultivating, computerization and advanced mechanics, animals innovation, present-day nursery rehearses, accuracy farming, man-made consciousness, and blockchain. How about we examine a portion of these agrarian innovations?

GIS-Based Agriculture: GIS software turns into an unbelievably helpful device as far as accuracy cultivating. While utilizing GIS programming, ranchers can plan current and future changes in precipitation, temperature, crop yields, plant well-being, etc. It likewise empowers the utilization of GPS-based applications by brilliant hardware to improve compost and pesticide application; considering that ranchers don't need to treat the whole field, yet just arrange with specific regions, they can accomplish preservation of cash, exertion, and time.

Satellite-Derived Data: Anticipating yields, as well as leading practically continuous field observing, to distinguish an assortment of dangers with satellite information in assistance has never been so natural. The sensors can give symbolism in different spectra, considering the use of various otherworldly lists, for example, the Normalized Difference Vegetation Index (NDVI). NDVI takes into consideration the recognition of vegetation content, how much withering plants are, and by and large plant wellbeing.

Data From The Sky – Drones: With the help of robots ranchers have an amazing chance to characterize crop biomass, plant level, the presence of weeds, and water immersion in specific field regions with high accuracy. They convey better and more precise information with a higher goal in contrast with satellites. Drones are likewise viewed as unparalleled assistants in the fight against bugs; the attack is forestalled by applying the insect spray on the perilous regions utilizing drones, all while lessening the probability of direct openness prompting compound harming.

Indoor vertical farming: Indoor vertical cultivating can increment crop yields, beat restricted land regions, and even decrease cultivating's effect on the climate by chopping down the distance went in the production network. Vertical ranches are extraordinary in that a few arrangements don't need soil for plants to develop. Most are either aqua-farming, where vegetables are filled in a supplement thick bowl of water, or aeroponic, where the plant roots are efficiently splashed with water and supplements. Instead of normal daylight, counterfeit develop lights are utilized.

Farm Automation: Ranch computerization, frequently connected with "brilliant cultivating", is the innovation that makes cultivates more proficient and mechanizes the yield or animal creation cycle. A rising number of organizations are dealing with advanced mechanics development to foster robots, independent work vehicles, automated reapers, programmed watering, and cultivating robots. The advantages of mechanizing customary cultivating processes are fantastic by handling issues from shopper inclinations, work deficiencies, and the ecological impression of cultivating.

Livestock Farming Technology: Domesticated animals give genuinely necessary inexhaustible, normal assets that we depend on each day. Animals the board has generally been known as maintaining the matter of poultry ranches, dairy

ranches, steers farms, or other animals-related agribusinesses. This innovation can come as healthful advancements, hereditary qualities, and computerized innovation, from there, the sky is the limit. Animal innovation can upgrade or further develop the efficiency limit, government assistance, or the executives of creatures and animals.

Modern Greenhouses: In ongoing many years, the Greenhouse business has been changing from limited-scope offices utilized essentially for examination and stylish purposes (i.e., botanic nurseries) to fundamentally more huge scope offices that contend straightforwardly with land-based customary food creation. Joined, the whole worldwide nursery market presently creates almost US $350 billion in vegetables every year. Nurseries today are progressively arising that are enormous scope, capital-implanted, and metropolitan focused.

Precision Agriculture: Agribusiness is going through a development - innovation is turning into an essential piece of every business ranch. New accuracy horticulture organizations are creating innovations that permit ranchers to expand yields by controlling each factor of harvest cultivating, for example, dampness levels, bug pressure, soil conditions, and miniature environments. By giving more exact procedures for planting and developing yields, accuracy in horticulture empowers ranchers to increment effectiveness and oversee costs.

Blockchain: Blockchain's capacity of following proprietorship records and altering opposition can be utilized to settle dire issues, for example, food misrepresentation, security reviews, inventory network failure, and food discernibility in the ongoing food framework. Blockchain's remarkable decentralized structure guarantees checked items and practices to make a business opportunity for premium items with straightforwardness.

Artificial Intelligence: The ascent of computerized farming and its connected advancements has opened an abundance of new information potential open doors. Distant sensors, satellites, and UAVs can assemble data 24 hours every day over a whole field. These can screen plant well-being, soil condition, temperature, moistness, and so on. Sensors empower calculations to decipher a field's current circumstance as measurable information that can be perceived and helpful to ranchers for direction.

CONCLUSION

There is an incredible change in Indian farming inferable from changes in the monetary and exchange climate. To adapt to these progressions convenient, important, and precise data for the ranchers and different partners will assist them with pursuing ideal choices. ICT assumes an indispensable part in the proficient conveyance of data to the advantage of the ranchers. A few ICT-based drives have been classified given government, non-government, and cooperatives/private, and the equivalent is made sense of in the current paper. In light of the examination survey of the various drives, an endeavor has been made to suggest impending cutting-edge innovation with the help of horticulture and ranchers. These advances are to such an extent that GIS programming and GPS horticulture, Satellite symbolism, Drone and other ethereal symbolism, indoor vertical cultivating, computerization and advanced mechanics, animal innovation, present-day nursery rehearses, accuracy farming and man-made brainpower, and blockchain. These advances give a wide scope of answers for the agrarian business, for example, crop pressure recognition, further developing yield, microorganism identification, observing, and so forth, assume a critical part in the improvement of farming.

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