

New ICT and technology dissemination

models for achieving better farmer-scientist interface

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Indian agricultural extension system is known world over for its pluralistic nature, driven by multiple agencies. The estimates in India indicate that dissemination of advanced agricultural technological information to its 120 million farm holdings requires at least 1.3-1.5 million extension personnel against which the present availability is only 0.1 million. Of the 40.6% households who received extension assistance, only 11% of the services came from physical government machinery. More farmers depended on other progressive farmers, media including radio, TV, newspaper and private commercial agents. If Digital India delivers its promise, rural India will likely soon outnumber urban India online for a more real representation of the country. The use of Information and Communications Technology (ICT) for popularization of agricultural technologies is thus one way of addressing the information needs of farmers. While not a panacea for all of the problems facing extension, the integration of ICTs as a communication channel and as an enabler of change is considered a critical part of future reforms. Using ICT to achieve agricultural development goals requires supplementary investments, resources and strategies. Consistent investment in technology, capacity building and policy support are the important measures needed at this juncture.

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THE digital strategies in India were initiated based on five core necessities, viz. bringing efficiency in extension delivery, harnessing effective tools for research and education, need to mechanize (level of farm mechanisation is about 35% to 40% in India while most developed countries have over 90%), realizing financial inclusion including markets (farmer value realisation is between 20% to 30% versus the global benchmark of 50% to 60%) and bridging the broken value chains in Indian agriculture (food processing is still less than 15% in India compared to global averages of 30% to 40%). India has witnessed changes in each of the above mentioned factors and Indian agriculture is now poised to make dent in digital strategies. These interventions could create opportunities for Indian

farmers to raise their income levels and may provide strong impetus to India's overall economy as well.

The Indian government and public-private partnerships are developing and disseminating a series of innovative, networked solutions under the Digital India initiative, to increase availability, accessibility and applicability of agriculture services at farm level. Key government initiatives to promote digital agricultural strategies include National e-Governance Plan in Agriculture (NeGP-A), Mobile apps deployment, Knowledge Management Portals, Krishi Vigyan Kendra (KVK) Portal, Touch Screen Kiosks, Kisan Call Centres, Agri-Clinics, Common Service Centres, mKisan, Direct Benefit Transfer (DBT) schemes, Kisan TV and various other applications. Private

initiatives include digital start-ups in agriculture (such as CropInfo), e-choupal (of ITC), mobile apps (such as FarmRise by Monsanto), weather systems (such as Skymet), Reuters Market Light, Digital Traceability (such as SourceTrace), Direct Market Interventions (such as Naa Panta), etc.

ICTs in Agricultural Research

The Indian Council of Agricultural Research (ICAR) established its first Super Computing Hub under the project "Establishment of National Agricultural Bioinformatics Grid". maintained at the Centre for Agricultural Bioinformatics of the Indian Agricultural Statistics Research Institute (IASRI), the hub hosts microsatellite markers of pigeonpea, tomato, buffalo, goat and other agricultural commodities of

global importance to help scientists for development of elite varieties and breeds.

Consortium for e-Resources in Agriculture (CeRA), e-Publishing Online System for Indian Agricultural Journals, Digital Repositories like e-Granth, Krishikosh and KrishiPrabha, Knowledge Management Portals, Enterprise Resource Planning Solution, and Market Intelligence Centres with e-advisory services across the country are the digital initiatives of ICAR. e-courses for the graduate level academic programmes in seven disciplines namely: Agriculture, Fisheries Science, Dairy Science, Veterinary and Animal Husbandry, Horticulture, Home Science and Agricultural Engineering with 1107 credits and 15,820 lessons have been developed. Knowledge based Resources Information Systems Hub for Innovations (KRISHI) in agriculture, is being developed as a centralized data repository system of ICAR. Mobile apps developed by more than 100 ICAR research institutes, State Agricultural Universities, KVKs help farmers to get information about latest technologies developed in research labs. These apps facilitate the transfer of technologies from “lab to land”.

Agriculture Resources Information System Network (AGRISNET) is a mission mode project funded by the Ministry of Agriculture, Government of India to develop a comprehensive online knowledge portal to disseminate relevant information to farmers. The goal of the project is to follow an all-inclusive approach in terms of ensuring technological connectivity, development of system software and provision of hardware at agriculture department offices up to the block level in all states and union territories. All states have their own AGRISNET portals. For instance, Tamil Nadu's Department of Agriculture has successfully created an internet based information network for 80 lakh farmers in the state.

ICTs for adaptation to climate change in agriculture

India is one of the few countries in the world that uses space technology

and land based observations for generating regular updates on crop production statistics and providing inputs to achieve sustainable agriculture. The Indian Space Research Organization (ISRO) has strong remote sensing capabilities that are useful for various applications in the fields of agriculture. Satellite data, GIS and image processing technologies are being used in various domains of agriculture, as given below:

- Forecasting Agricultural output using Space, Agro-Meteorology and Land based observations (**FASAL**) – provides the multiple pre-harvest production forecasts of eight major crops at District/State/National Level.
- National Agricultural Drought Assessment & Monitoring System (**NADAMS**) provides the periodic agricultural drought assessment for 14 major states.
- Coordinated Horticulture Assessment and Management using geo-iNformatics (**CHAMAN**) helps in area and production estimation of seven horticultural crops in 12 states.
- Crop Insurance using Space technology and geo-iNformatics (**KISAN**) explores the use of remote sensing in assessment of crop yield.

National Remote Sensing Centre (NRSC) in association with the government departments has undertaken geo-tagging of agricultural resources assets for effective monitoring and utilization. This facilitates “Farmer-centric” and “Farm-centric” advisory services.

Digital India Land Records Modernisation Programme (DILRMP) is updating millions of land records, providing title guarantees and increased security of land tenure to farmers while stimulating land rentals by non-viable smallholders and land consolidation. Seamless integration of different nutrient management, diagnostic, pest surveillance platforms developed by ICAR with Aadhar enabled Fertilizer Distribution System (of DAC under NeGPA 2.0) will bring precision agriculture to the door step of farmers.

ICTs in Agricultural Extension Services

India Development Gateway (IndG): It is supported by Ministry of Communications and Information Technology, Government of India and implemented by Center for Development of Advance Computing (C-DAC), Hyderabad. The multilingual website www.indg.in is a one stop portal to people who seek information in Indian languages related to six livelihood domains (Agriculture, Health, Primary Education, Rural Energy, Social Welfare and E-Governance). Vikaspedia having state-wise language portals for better user interface, can be accessed through, www.vikaspedia.in.

DACNET: An E-Governance Infrastructure for the Globalization of Indian Agriculture is a project of Department of Agriculture and Cooperation (DAC), Ministry of Agriculture. DACNET is implemented by the National Informatics Centre—the technology division of the Indian government. DACNET facilitates Indian ‘agriculture online’. DACNET’s key criteria include ease-of-use, speed of information delivery, low incidence of errors, reduction in corruption, and affordable services.

Farmers portal: User farmer will be able to get all relevant information on specific subjects related to his/her location. This information is delivered in the form of text, email and audio/video in the local language. These levels can be easily reached through the Map of India placed on the Home page. Farmers will also be able to ask specific queries as well as give valuable feedback through the feedback module specially developed for the purpose.

Kisan Suvidha: This mobile app provides information on five critical parameters—weather, input dealers, market price, plant protection and expert advisories. An additional tab directly connects the farmer with the Kisan Call Centre (KCC) where agriculture experts answer their queries. Unique features like extreme weather alerts and market prices of commodity in nearest market and the maximum price in state as well as

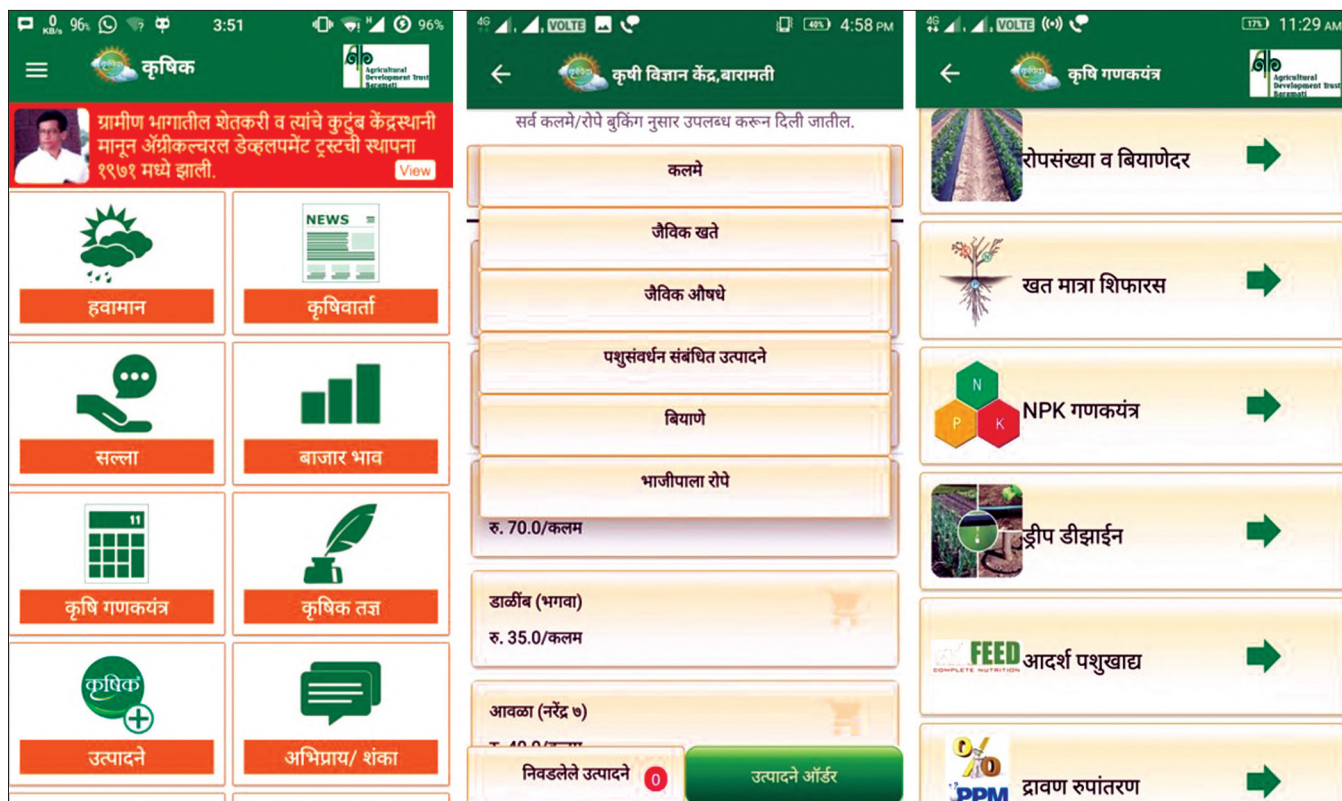


Fig. 1. KRUSHIK mobile app.

India have been added to empower farmers in the best possible manner.

Agrimarket: This mobile app can be used to get the market price of crops in markets within 50 km of the device's location. Crop Insurance app can be used to calculate the insurance premium for notified crops based on area, coverage amount and loan amount in case of loanee farmer. Though these are evolving over a period of time and integration of all the apps into a single interface (such as Bharat Interface for Money – BHIM App) will help farmers realize digital dividends.

Kisan Call Centres: Ministry of Agriculture launched the personalized query redressal system "Kisan Call Centres (KCCs)" on January 21, 2004. Main aim of the project is to answer farmers' queries on a telephone call in their own dialect. A countrywide common Toll Free number 1800-180-1551 is accessible through mobile phones and landlines of all telecom networks including private service providers. Replies to the farmers' queries are given in 22 local languages, from 6.00 AM to 10.00 PM on all seven days of the week. Call Centre agents known as Farm Tele Advisor (FTAs) are

graduates in agriculture or allied disciplines. Queries which cannot be answered by Farm Tele Advisor (FTAs) are transferred to higher level experts in State Agriculture Departments, ICAR and State Agricultural Universities, in a call conferencing mode.

Common Services Centres (CSC): These are the access points for delivery of essential public utility services, social welfare schemes, healthcare, financial, education and agriculture services, apart from host of B2C (Business to Customer) services to citizens in rural and remote areas of the country. In view of the importance of geo-informatics in e-Governance, the National Centre of Geo-Informatics (NCoG) of the Ministry of Electronics and Information Technology has been established to promote "geo-informatics" technology, through its "GIS based e-Governance Process". Geomatics Solutions in Indian agriculture are likely to bring digital disruption by providing farmers what they want in a personalised way.

KRUSHIK Mobile App: The KRUSHIK Mobile App (Fig. 1) is developed by Agricultural Development Trust's KVK Baramati

during 2016 in Marathi language. Major features of the app are Tehsil based weather forecast for next seven days, agricultural news, agro advisory viz. crop, animal husbandry, poultry, goat rearing, weather advisory, market rates of different commodities, and agricultural related training programs. There are calculators to calculate drip design, seedling and seed requirement, animal feed, and soil nutrients.

Kisan Mobile Advisory Service (KMAS): As a major pillar of Research-Extension-Farmer linkage, the KVKs are using ICTs in every activity. Kisan Mobile Advisory Service (KMAS) was initiated by the ICAR during 2010-11 to provide timely and need-based information to farming community. Short text and voice messages are sent to farmers by all the KVKs on various aspects of agriculture, horticulture, animal husbandry, weather forecast, pest management and disease control.

KVK Portal: It is an exclusive portal (<http://kvk.icar.gov.in>) that works as a platform to provide information and advisory to farmers on real-time basis. This also serves as online monitoring system to review and monitor the functioning of

KVKs. The portal provides information on different services being provided by different KVKs. The forthcoming programmes are also made available on the website which will benefit farmers and youth in joining different training programmes being organized by KVKs. Question and answer facility and the district agriculture related information are available on the portal. The farmers and the Agricultural Officers may register themselves and seek different information related to KVKs.

Access to market information through ICT

National Agriculture Market (eNam), is an online platform for farmers that integrates agricultural markets online. It allows farmers and traders alike to view all Agriculture Produce Market Committee-related information and services, commodity arrivals and prices, buy and sell trade offers, thus helping farmers bid for the best prices across markets.

The e-Krishi is a novel ICT initiative in the sphere of agricultural trade implemented by the Kerala State Information Technology Mission (KSITM). The project is carried on the existing resources of Akshaya e-Kendras for providing the services. Sellers (farmers) and buyers (merchants) register through nearest Akshaya Centre or log on to www.e-krishi.org, post the materials for selling/buying, post and view advertisements and virtual meeting of buyer and sellers through the web and effect transaction. A Toll Free Call Centre helps farmers and buyers in solving trade related doubts, provides details on good agricultural practices including local weather.

Robotics and IoT

The Information Technology Research Academy (ITRA), Hyderabad set up by the Ministry of Electronics and Information Technology, had identified various areas for research purpose in respect of robotics, sensors, interpretation and use of sensor data in consultation with the Indian Council of Agricultural Research (ICAR). The Indian Agriculture Research Institute

(IARI), New Delhi is working on a collaborative research project entitled **SENSAGRI (SENSOR based Smart Agriculture)** involving six partner institutes under the ITRA Project Funding, to develop indigenous prototype for Drone based crop and soil health monitoring system using Hyperspectral Remote Sensing (HRS) sensors, so as to be integrated with satellite-based technologies for large scale applications. Such joint research efforts are recommended, to be undertaken and completed as per timelines.

Artificial Intelligence (AI) has to play an important role for smart agriculture and providing solutions to farmers. Therefore, more professionals are needed in the sector along with more investment.

Policy support for ICT driven Research and Extension Services

Seamless integration and exponential thinking is required for bringing digital disruption in Indian agriculture. The basic principles to realize digital disruption in agricultural organizations are given here.

- Optimizing the organizations with available digital start-ups, collaborations and partnerships. Recognizing the role of plurality in digital strategies and their complementarity is essential.
- Empowering extension professionals to take up the challenges and encouraging them to enjoy flexibility in terms of tasks.
- Transforming Extension Advisory Services with structural and functional adjustments along with focus on collective action.

To realise the digital disruption in Indian agriculture we need to create avenues for redesigning the processes (workflows and frameworks), stimulate new thinking (capturing innovations and start-ups within the system) and include crowd sourced research and development innovations (allowing partnerships and local redesigning to certain extent).

For redesigning the extension processes, the national systems may draw lessons from the digital start-

ups under four categories i.e. precision agriculture, financial inclusion, data-driven agriculture and digital knowledge sharing/delivery.

The local government bodies (like village Panchayat) could be made a focal point for technology sharing with needed infrastructural facilities. The telecom companies must ensure net connectivity with high speed in rural areas which requires more investment. The successful ICT models at national and regional level may be up-scaled. It has been observed that a lot of information is shared through social media which needs proper regulation mechanism for content monitoring. A comprehensive security standard and protocols are required for the development of projects having sensitive information.

SUMMARY

ICTs continue to gain popularity and offer unique opportunities to share information among large number of farmers and other stakeholders. While not a panacea for all of the problems facing extension, the integration of ICTs as a communication channel is potentially reaching millions of farmers and as an enabler of change is considered a critical part of future reform and investment agendas. Using ICT to achieve agricultural development goals requires supplementary investments, resources, and strategies. The attractiveness of the newest ICTs can lead to a preference for the latest technologies at the expense of older technologies (such as radio), yet the newest, most elaborate, or most innovative technology is not automatically the most appropriate one. An innovative mix of technologies, for instance, radio programs with a call-in or SMS facility for feedback, can also be a cost-effective solution.

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