

Digital Kranti in Agriculture: How Extension Services Are Reaching Every Farmer

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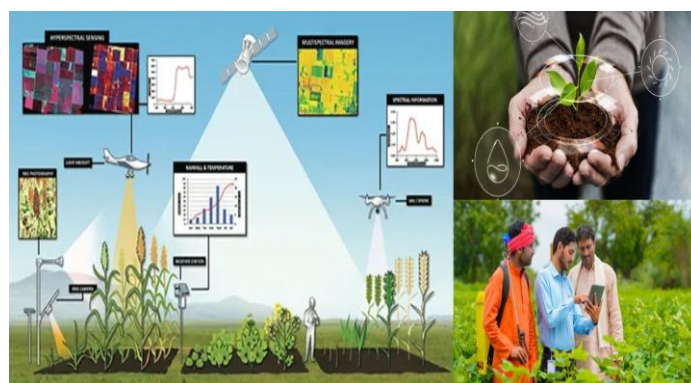
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INTRODUCTION

Agriculture has always been knowledge intensive, but the value of that knowledge depends on whether it gets to the farmer at the right time. A seed treatment advice given after sowing, a pest warning received after crop loss, or a rainfall forecast relayed after irrigation has little practical value. For decades, agricultural extension was based primarily on field visits, demonstrations, training programs, radio broadcasts and printed materials. These channels are still significant, but with numerous challenges such as limited personnel, dispersed villages, and the increasing complexity of farming, it is hard to offer every household with prompt, location-specific assistance. India's digital revolution is now transforming the space, taking extension beyond the offices and meeting halls and straight to the farmers mobile phones.



The New Meaning of Agricultural Extension

Digital extension is very different from simply posting farming practices on a website. The dissemination of agriculture information is facilitated by means of mobile calls, text, voice messages, applications, videos, social networking, artificial intelligence (AI), satellite information, weather data and online marketplaces to link farmers to knowledge and vital services. A farmer can get a rain alert, ask about a diseased leaf, check mandi prices, read an insurance clause or pick up a new production technique without travelling to a distant office.

Communication becomes two-way as farmers report on field conditions, send photographs and ask questions, and specialists adjust recommendations accordingly.

farmer in Odisha will look for alerts on heavy rain, floods, disease outbreaks. With all the records going digital, such communications can be more focused, if the data remain accurate and are handled with due consent and security.

Newer platforms are now a testament to the fact that the farmer-public institution interface is also getting transformed. Kisan e-Mitra has employed voice-based artificial intelligence to respond to farmers queries on major farm schemes in 11 regional languages. It is said to have responded to over 93 lakh queries by December 2025. Bharat-VISTAAR, which was launched in its first stage in February 2026, takes this idea forward by integrating details of government schemes, ICAR (Indian Council of Agricultural Research) production recommendations, weather predictions, mandi (pricing) rates and grievance procedures in a conversational digital gateway. Farmers can avail it using either a phone number, via voice based chatbot, or through a web portal or a mobile app.

Many Channels, One Extension Ecosystem

There is no single digital system that could meet the needs of Indian agriculture in all its variations. SMS still has its place for brief weather and pest alerts, while interactive voice-response systems are accessible to farmers with feature phones. Call centres allow for more in-depth discourse, messaging groups are for quick interaction, and how-to videos can more effectively explain pruning, grafting, machinery calibration, or disease symptoms than written guides.

Kisan Call Centres operate in 22 official languages and enables farmers to directly speak with trained agricultural advisors. District and crop-specific agrometeorological advisories provided through agriculture informatics-based

Meghdoot application guide farmers on when to sow, irrigate, fertilize, spray and harvest, based on anticipated weather. The e-National Agriculture Market builds on the information system from production to marketing. Connecting 1,656 mandis and having more than 1.80 crore registered farmers, it provides a way for farmers to access more pricing information and electronic trading opportunities by March 2026.

Social media and farmer groups introduce a social aspect to digital extension. Extension workers, Krishi Vigyan Kendras (KVKs), state departments, agricultural universities, farmer-producer organisations (FPOs) and agritech firms are also increasingly leveraging platforms such as WhatsApp, YouTube and live online sessions to disseminate advisories and demonstrations. Farmers don't only get informed; they exchange experiences, highlight local outbreaks and trade practical solutions.

Artificial Intelligence and Precision Advice

Agricultural information can be processed by artificial intelligence to provide answers in a matter of seconds in the local language. Image-based systems analyzes images captured by mobile phone cameras to detect pest infestation, diseases and nutrient deficiencies in crops. Predictive models may integrate weather forecasts, crop stages, and pest-surveillance records to alert them in advance. Generative AI has the capability to convert technical advice into straightforward conversational responses that make the advice easier for farmers to comprehend. These technologies can also enhance the work of extension staff. An AI might answer common questions, compile field reports, and highlight villages with similar challenges. Extension agents will then have more time to focus on the more complex cases that require field visits, lab testing, or comprehensive farm design.



Nevertheless, AI-generated advice should be considered as intelligence assistance, rather than an oracle. Similar leaf symptoms may be caused by a pathogen, a nutrient deficiency, chemical injury, or water stress. A model designed for one crop or region can give misleading results for another, while fluent language can make wrong advice seem authoritative. Critical questions on pesticides, animal health, credit, insurance, or severe weather must be based on verified databases and expert advisement. An accountable system would acknowledge uncertainty, seek additional information, and refer to human experts when appropriate.

Evidence of Real Benefits

Emerging evidence suggests that well-designed digital extension can enhance farmer knowledge and incentivize adoption of recommended practices. A large-scale randomized evaluation among 13,675 rice farmers in five districts of Odisha demonstrated that access to a digital advisory service positively affected agricultural knowledge and the adoption of recommended practices. It also yielded slight average gains in yield and harvest while decreasing the likelihood of crop loss. The gains were particularly pronounced in some regions hit by bad weather. This

evidence would also be consistent with digital extension being most useful where farmers are forced to respond in real-time to rainfall uncertainty, pests or other production shocks. The information is timely, allowing them to reschedule irrigation, protect stored inputs, modify fertilizer use, delay pesticide application, and/or harvest a mature crop before the arrival of bad weather. It is not only about crop production. Digital advisories can help avoid overapplication of pesticides, ensure proper timing of irrigation and fertilizer application, reduce costs of travelling to extension offices, and link farmers with input suppliers, machinery services, insurance, credit and markets. Digital records can also help make scheme delivery and grievance tracking more transparent. For the extension agencies, farmers questions will also indicate new problems at the local level and alert field staff to villages which may require their urgent attention.

The Last-Mile Challenge

Reaching every farmer remains an ambition rather than an accomplished reality. Weak internet connectivity, unreliable electricity, device and data costs, low digital confidence and fragmented platforms continue to exclude many rural households. Women farmers often

have less control over mobile phones and digital accounts. Tenant farmers, sharecroppers, pastoralists, tribal communities and people speaking low-resource dialects may be poorly represented in databases and advisory content. Even registered farmers may receive irrelevant messages if their crop, land or contact details are outdated.

Digital literacy is not simply the ability to operate a smartphone. Farmers must also be able to judge whether information is reliable, distinguish official advice from commercial promotion and understand the risks associated with sharing personal data. Training should therefore cover safe and informed use of digital services, not merely application installation.

Trust is equally important. Farmers are more likely to follow recommendations when the information is understandable, locally tested and delivered through a familiar institution. They should know what personal information is collected, why it is required, who can access it and how incorrect records can be corrected. Digital identity should simplify access to services without becoming a new barrier for farmers whose records are incomplete. Platforms must collect only necessary information, obtain meaningful consent and prevent unauthorized commercial use of farm data.

The Phygital Path Forward

The most inclusive future for agricultural extension is phygital a combination of digital reach and physical support. India's network of 731 Krishi Vigyan Kendras, extension officers, agri-clinics, community resource persons, farmer-producer organisations and trained rural youth can provide the trusted human layer of the digital system. Village demonstrations and field diagnosis should validate digital recommendations, while Common Service Centres and local facilitators can assist farmers who do not own suitable devices.

Women's self-help groups, cooperatives and farmer producer organisations too can pool resources to devices and ensure that digital services cater to local priorities. Rural youth could be trained as digital extension facilitators who assist farmers in registering on platforms, uploading crop photographs, interpreting advisories and connecting with specialists. Success should not be gauged only through downloads, sign-ups or messages sent. More evolved metrics are whether the farmers understood the advice, practiced it safely, suffered less crop loss, used resources more efficiently and earned more. Platforms should have local-language feedback systems, be subjected to independent accuracy testing and be regularly updated by agricultural universities and research institutions. They should also work in low-bandwidth environments, include voice and offline interfaces, and have accessible mechanisms for complaints and human support.

CONCLUSION

The digital kranti is changing agricultural extension from an one-time information dissemination to a continuous and demand-driven interface. Mobile communications, AI, weather services, remote sensing, and digital public goods can make scientific knowledge closer to the farm, more timely, customized and actionable. But technology alone cannot influence every farmer. Universal extension will enable inclusive design, trusted local content, responsible data governance and the continued presence of capable individuals in rural communities. When farmers get to access dependable advice in a language they understand, validate it locally and use it at the right time, digital agriculture is more than connectivity is practical empowerment.