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Building Digital-Ready Extension Systems: Strengthening Human Capital for Data Driven Agriculture

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The transformation of agriculture through digital innovation depends not only on the availability of technology but also on the capacity of extension and advisory services (EAS) to interpret and utilize data effectively. As India accelerates its digital agriculture mission, the role of trained, tech-enabled extension personnel becomes critical. This article explores the strategic importance of capacity building in enabling EAS to harness digital platforms for inclusive, responsive, and climate-resilient farming. Drawing on national frameworks, Odisha-based insights, and global best practices, the article presents a multi-tiered approach to empower EAS professionals with the tools, skills, and mindset necessary to lead the next era of agricultural transformation.

Keywords: Capacity building, digital extension, agricultural data, human resource development, agricultural advisory, digital agriculture, knowledge systems, training, extension reform, India

Introduction

India's agricultural sector is at the forefront of digital disruption, driven by mobile technology, big data, satellite imaging, and AI-powered decision support systems. But this transformation hinges on a crucial, often overlooked element: the people delivering knowledge to farmers. These individuals—extension agents, agri-entrepreneurs, field officers—are the frontlines of innovation diffusion. Yet many remain unequipped to fully engage with the digital tools being deployed around them. For decades, India's extension services have relied heavily on face-to-face communication, pamphlets, and radio broadcasts. Today, these methods are insufficient to address the complexity of climate risks, market fluctuations, and site-specific crop advisories. What is needed is a digitally empowered EAS workforce, capable of collecting, analyzing, interpreting, and communicating real-time information. This article explores how structured, multi-level capacity building can bridge this gap, enhance technology adoption, and reshape agricultural extension into a modern, responsive, and inclusive service ecosystem.

Why Capacity Building Is Central to Digital Agriculture

As digital tools become more prevalent in agriculture, the role of EAS must evolve from **technology promoters** to **data interpreters, advisors, and connectors**. For this transformation to happen, professionals must be equipped with a new set of competencies, including:

- **Digital literacy:** Basic understanding of mobile apps, internet tools, and data collection interfaces. Without this, even simple IVRS or SMS systems remain unused.
- **Analytical skills:** Ability to make sense of data from weather stations, crop models, market dashboards, and remote sensing platforms.

- **Communication competence:** Translating complex data into farmer-friendly language, especially in local dialects and culturally sensitive formats.
- **Critical thinking:** Evaluating multiple sources of data to make context-specific recommendations, especially in dynamic climatic or market environments.
- **Ethics and privacy:** Understanding the responsibilities of handling farmer data with care, particularly with the rise of Agristack and national agri-databases.

Without robust investment in human capital development, even the most promising digital platforms risk poor adoption, misinterpretation, or erosion of farmer trust.

A Tiered Approach to Capacity Building

An effective model for strengthening extension capacities must recognize that different actors within the EAS ecosystem play distinct roles. The **tiered approach** advocated in the CGIAR-IFPRI study provides a practical framework:

Level 1: Data Generators

These are the village-level functionaries—frontline workers, agri-input dealers, community volunteers—who are often the first point of contact for farmers. Their role is essential for gathering ground-level data and disseminating advisories.

Training focus:

- Use of digital forms and mobile data collection apps;
- Basic GPS and geo-tagging techniques for farm mapping;
- Methods to capture qualitative data (e.g., pest outbreaks, irrigation access).

Example:

In Gujarat, women-led “Krishi Sakhis” use handheld tablets to collect information on seed varieties and yield performance for government dashboards.

Level 2: Data Interpreters

This includes block-level agricultural officers, KVK staff, private extension advisors, and NGO trainers. These professionals serve as the analytical bridge between raw data and decision-making tools.

Training focus:

- Dashboard analysis using tools like eNAM, Mandi Bhav, or state GIS systems;
- Data triangulation from sources like rainfall, soil health cards, and market prices;
- Developing customized recommendations based on farmer profiles and location.

Example:

Odisha’s agriculture officers use a rainfall monitoring dashboard linked to mobile alerts for pest control advisories.

Level 3: Decision-Makers and Planners

At the apex are district-level officers, directors of agriculture, and policy makers. Their capacity determines how digital tools shape resource planning, scheme implementation, and systemic reform.

Training focus:

- Integration of macro-data for planning (e.g., satellite imagery, yield estimates);
- Cost-benefit analysis of digital advisory platforms;
- Governance models for public-private partnerships in digital advisory services.

Example:

State officials in Telangana used crop-cutting experiment data overlaid on satellite maps to streamline compensation under the Rythu Bandhu scheme.

Components of an Effective Capacity Building Program

To be impactful, capacity-building initiatives must move beyond one-off workshops and towards **continuous, adaptive, and inclusive learning systems**. The key components include:

a. Needs-Based Curriculum Design: Start with a skill-gap analysis for each tier. For example, data generators may need vernacular app literacy, while planners may benefit from modules on open-source analytics or spatial data interpretation.

b. Blended Learning Models: Use a mix of physical training (Krishi Vigyan Kendras, Agri Polytechnics) and digital platforms (e-learning portals like MANAGE's SAMETI LMS). Community radio, WhatsApp groups, and YouTube channels can supplement formal modules.

c. Contextualization and Localization: All content must be tailored to local cropping systems, market cycles, and dialects. For tribal and low-literacy areas, voice-based training or picture-led guides can be more effective.

d. Certification and Career Pathways: Create recognition mechanisms such as digital credentials, micro-certificates, and promotion-linked learning. This will incentivize skill upgrading and attract youth to extension careers.

e. Embedded Monitoring and Feedback: Pre- and post-assessments, feedback loops from farmers, and real-world application case studies should guide future training improvements.

Institutional and Policy Enablers

Effective capacity building depends on aligning training initiatives with broader institutional and policy structures. Critical enablers include:

Policy Integration: Government schemes like NeGP-A, PM-Fasal Bima Yojana (PMFBY), and the Digital Agriculture Mission must embed capacity-building components. Funds should be earmarked for staff development alongside tech rollout.

Academic Collaboration: Agricultural universities, management institutes, and ed-tech firms should co-create digital content and host training labs. Public-private models like the Tata Trusts–Govt. of Odisha Digital Training Hub show promising results.

Infrastructure and Connectivity: Without stable electricity, devices, and mobile networks, training remains theoretical. Rural training centers should be equipped with solar power, Wi-Fi, and smart classrooms.

Gender Inclusion: Women comprise a large part of India's agri-workforce but are underrepresented in extension roles. Special fellowships and SHG-linked digital training models can correct this imbalance.

Institutional Memory and Knowledge Sharing: Create a national repository of successful training curricula, digital case studies, and impact reports, hosted by institutions like MANAGE or ICAR.

The Road Ahead: From Training to Transformation

Capacity building for digital agriculture is not a one-time investment; it's an evolving journey. It requires **long-term vision, iterative learning, and co-creation** between technologists, extension professionals, and farmers.

Future steps include:

- Establishing a **National Digital Extension Academy** to standardize modules, certify trainers, and mentor state-level academies.
- Using **AI tutors and gamification** to make training more interactive and self-paced.
- Promoting **Digital Champions** or peer trainers in every Panchayat to ensure hyper-local outreach.
- Embedding **resilience and climate literacy** into all training content, especially for dryland and flood-prone regions.
- Developing **feedback dashboards** to track advisory quality and farmer satisfaction in real time.

In essence, transforming agriculture requires transforming those who serve farmers. With the right capacity, India's extension ecosystem can become the linchpin of an intelligent, inclusive, and climate-proof agricultural future.



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