

Empowering Youth and Women through Digital Agriculture: Skills, Opportunities and Pathways for Inclusive Agrifood Transformation

Amtul Waris and S Arun Kumar

ICAR-IIRR, Hyderabad

Corresponding Email: amtul.waris@gmail.com

Agriculture is undergoing a significant transformation as digital technologies reshape the way food is produced, managed, marketed and consumed. Technologies such as artificial intelligence, drones, remote sensing, mobile-based advisory services, Internet of Things (IoT), digital financial services and e-commerce are moving agriculture from conventional, experience-based decision-making towards more data-driven, precise and market-oriented systems. This transformation is particularly significant for rural youth and women, who are not only important contributors to agrifood systems but also, represent a major potential workforce for the emerging digital agricultural economy. Digital agriculture can open new pathways for them as skilled farmers, technology users, service providers, entrepreneurs and innovators across the agricultural value chain. However, unequal access to digital devices, connectivity, finance, training and relevant knowledge can prevent them from fully benefiting from these opportunities. Therefore, building digital competencies among rural youth and women, alongside strengthening access to technology and supportive institutions, is essential for ensuring that digital transformation becomes inclusive and contributes to productive employment, entrepreneurship, economic empowerment and sustainable agrifood systems.

Digital Skills: A Foundation for the Future of Agrifood Systems

Digital technologies are rapidly transforming agricultural production, processing, marketing, financial services and climate-resilient farming. From mobile-based crop advisories and digital marketplaces to drones, sensors, artificial intelligence and smart irrigation systems, digital tools are creating new possibilities for making agrifood systems more productive, efficient, sustainable and inclusive.

The growing importance of digital agriculture also highlights the need to develop a workforce equipped with relevant digital competencies. According to the Food and Agriculture Organization (FAO 2025), about 44 per cent of working youth globally is employed in agrifood systems, with the proportion being considerably higher in low- and middle-income countries. This demonstrates the critical role of agriculture and allied sectors in providing livelihoods and employment opportunities for young people.

However, the benefits of digital transformation cannot be realized without appropriate skills and access. Rural communities, particularly youth and women, often face limitations in digital infrastructure, connectivity, devices, digital literacy and access to training. Strengthening education, vocational training and extension systems is therefore essential to equip rural populations with the competencies required for the future of agriculture.

Youth and Women at the Centre of Agrifood Transformation

Youth and women are critical stakeholders in the transformation of agrifood systems. Young people can contribute innovation, technological adaptability and entrepreneurial capabilities, while women play vital roles across agricultural production, post-harvest management, food processing, household nutrition and local value chains. FAO (2023a) emphasizes that gender equality and women's empowerment are essential to improving the performance and inclusiveness of agrifood systems.

Despite their contributions, both groups continue to face structural barriers, including limited access to land, finance, technology, markets, information and decision-making opportunities. These constraints can restrict livelihood diversification, enterprise development and meaningful participation in agricultural value chains. Digital agriculture provides opportunities to improve access to knowledge, services, markets and financial resources, helping reposition agriculture as a modern, technology-driven and economically viable livelihood for young women and men.

Digital Agriculture as an Enabler of Inclusion

Digitalization is increasingly influencing how food is produced, processed, transported and marketed. Nevertheless, digital transformation remains uneven, particularly among rural and disadvantaged communities. According to GSMA (2025), women in low- and middle-income countries were 14 per cent less likely than men to use mobile internet, highlighting persistent inequalities in digital access and use.

Inclusive digital transformation requires moving beyond the provision of technologies alone. Youth and women need affordable access, practical skills, confidence, mentorship and opportunities to apply digital tools in real agricultural situations. Young people can leverage their interest in digital technologies and entrepreneurship to

develop services across the agricultural value chain, including digital advisory services, input management, precision farming, food processing, branding, e-commerce and direct marketing. FAO (2023b) highlights the potential of digital innovation to reduce information and transaction costs, improve service delivery and create employment opportunities for youth and women in agrifood systems.

For women, digital platforms can provide opportunities to access markets, participate in producer organizations, manage enterprises, promote value-added products and strengthen financial inclusion. Digital tools can therefore contribute not only to agricultural productivity but also to greater economic agency and participation in decision-making.

Creating Digital Opportunities for Youth and Women

Digital agriculture can generate employment and entrepreneurship opportunities beyond conventional farming. Emerging technologies can create new roles for rural youth as:

- Drone operators and service providers
- Digital agriculture entrepreneurs
- Farm data and advisory service providers
- IoT and smart-irrigation technicians
- Digital marketing and e-commerce facilitators
- Agri-input and machinery service providers
- Custom-hiring and precision-farming service entrepreneurs
- Digital financial service facilitators
- Agri-startup and value-chain entrepreneurs

India's Initiatives for Skilling Rural Youth

Under the Government of India's Skill India Mission (SIM), the Ministry of Skill Development and Entrepreneurship (MSDE) delivers skill, re-skill and up-skill training through an extensive network of skill development centres under various schemes, viz. Pradhan Mantri Kaushal Vikas Yojana (PMKVY), Jan Shikshan Sansthan (JSS), National Apprenticeship Promotion Scheme (NAPS) and Craftsman Training Scheme (CTS) through Industrial Training Institutes (ITIs), to all the sections of the society across the country. The SIM aims at enabling the youth of India to get future-ready, equipped with industry-relevant skills. The Government is committed to promote digitalisation and enhance skill development among youth (PIB 2026).

Special attention has been given to preparing the younger generation of farmers for emerging opportunities in

agriculture. The Skill Training of Rural Youth (STRY), programme has been designed to impart short-term, skill-based training of about seven days to rural youth and farmers in agriculture and allied sectors. The aim is to upgrade their knowledge, promote wage and self-employment, and create a pool of skilled manpower in villages. Recently, the programme has been subsumed under the ATMA cafeteria, ensuring closer integration with state-led extension efforts. Such initiatives can play an important role in creating a digitally capable rural workforce by linking agricultural knowledge with emerging technologies, entrepreneurship and market opportunities (PIB 2025).

Key Digital Skilling Areas for Rural Youth and Women in Rice Production

Digital skilling can empower rural youth and women to become skilled rice producers, digital service providers, agripreneurs and leaders in climate-smart agriculture. Training should combine digital literacy, hands-on technical competencies, entrepreneurship and practical applications across the rice value chain, from production to processing and marketing.

1. Digital Literacy and Mobile-Based Advisory Services

- Smartphone operation, internet use and digital communication.
- Accessing mobile-based rice advisories, weather forecasts and pest alerts.
- Using agricultural apps and government digital platforms.
- Digital safety, privacy and responsible information sharing.

2. Precision and Climate-Smart Rice Farming

- Using weather information for crop planning and climate-risk management.
- Digital soil testing, nutrient management and irrigation scheduling.
- Sensor-based irrigation, alternate wetting and drying (AWD), and water monitoring.
- Digital tools for pest surveillance and integrated pest management.

3. Drones, Remote Sensing and Smart Farm Equipment

- Understanding drone-based crop monitoring and field mapping.
- Interpreting satellite imagery and crop-health information.
- Using GPS-enabled equipment and digital farm records.

- Training as drone operators, equipment technicians or custom-hiring service providers, subject to applicable regulations.

4. Artificial Intelligence and Digital Farm Data

- Using AI-enabled tools for crop advisory and problem identification.
- Recording farm operations, input use, labour and production costs.
- Maintaining digital crop calendars, yield records and farm databases.
- Interpreting digital recommendations and verifying information with agricultural experts.

5. Digital Financial Literacy and E-Commerce

- Digital payments, mobile banking and financial recordkeeping.
- Accessing eligible digital financial services and understanding credit options.
- Online marketplaces, e-commerce and digital customer engagement.
- Product branding, packaging, online promotion and direct marketing of rice and rice-based products.

6. Digital Skills for Rice Processing and Value Addition

- Digital monitoring of milling, drying, storage and grain quality.
- Inventory management, traceability and quality documentation.
- Digital marketing of specialty rice, biofortified rice and rice-based foods.
- Using business software to manage costs, orders, sales and customer feedback.

7. Digital Agripreneurship and Service Enterprises

- Operating digital advisory and farm-data services.
- Providing sensor installation, smart-irrigation and equipment services.
- Developing agri-startups, custom-hiring centres and digital marketing enterprises.
- Using digital tools for business planning, customer acquisition and enterprise management.

8. Digital Extension, Communication and Leadership

- Creating short videos, voice messages and local-language learning materials.
- Participating in online farmer groups and virtual training.

- Using digital tools for farmer surveys, demonstrations and feedback.
- Becoming community digital champions, peer trainers and women-led farmer group facilitators.

From Digital Literacy to Digital Agripreneurship

The ultimate objective should not be limited to making youth and women users of digital technologies. They should be encouraged to become providers, entrepreneurs and innovators within the digital agricultural ecosystem. A rural youth trained in drone operation can become a drone service provider. A young woman trained in digital marketing can establish an online enterprise for farm products. A trained rural entrepreneur can provide soil-testing, IoT irrigation or digital advisory services to neighbouring farmers. This transition from digital users to digital service providers and agripreneurs can create local employment while improving access to agricultural technologies for the wider farming community.

Benefits of Digital Agriculture Adoption

Effective digital adoption by youth and women can contribute to:

- **Higher productivity:** Better and more timely farm-management decisions.
- **Resource-use efficiency:** Reduced wastage of water, fertilizers, pesticides and labour.
- **Climate resilience:** Improved access to weather information, early warnings and climate-smart practices.
- **Employment generation:** Creation of new technology-based rural services and enterprises.
- **Market access:** Greater access to price information, buyers and digital marketplaces.
- **Financial inclusion:** Increased use of formal and digital financial services.
- **Entrepreneurship:** New opportunities for rural agripreneurship and service enterprises.
- **Women's economic empowerment:** greater participation in markets, enterprises and agricultural decision-making.
- **Youth engagement in agriculture:** Making agriculture more attractive as a technology-enabled and commercially viable profession.

Way Forward: Building an Inclusive Digital Agricultural Workforce

- Build locally relevant digital-skilling programmes. Agricultural universities, ICAR institutes, KVKs, extension



organizations, Skill India institutions, FPOs, startups and private technology providers should collaborate to develop practical programmes.

- Combine digital training with hands-on learning. Training should include field demonstrations, mentoring, entrepreneurship development and access to digital infrastructure rather than focusing on technology alone.
- Prioritize rural youth and women with limited access. Special attention should be given to those facing constraints in devices, connectivity, finance and technology-based services.
- Deliver training in local languages. Digital-skilling programmes should be designed around practical agricultural problems and communicated in locally accessible languages.
- Strengthen pathways from digital literacy to digital agripreneurship. Rural youth and women should be encouraged to become technology users, service providers, entrepreneurs and innovators within the digital agricultural ecosystem.

- Integrate digital skills with rice production and value chains. Priority areas include precision agriculture and drone operation, digital crop advisory, data-based farm management, smart irrigation and IoT, digital marketing and e-commerce, and digital financial services.

- Use extension systems to connect skills with opportunities. Linking skilling initiatives with agricultural extension frameworks, producer organizations and emerging digital service ecosystems can improve employability, self-employment and entrepreneurship

Conclusion

The future of agriculture will increasingly depend on the ability of rural communities to combine traditional agricultural knowledge with digital intelligence. By investing in the digital skills of youth and women, India can create a new generation of digital farmers, rural technology providers and agripreneurs, making agriculture more productive, profitable, climate-resilient and inclusive.

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