Review

# Transforming agricultural knowledge management through information and communication technology (ICT): opportunities, challenges and strategies

**NARINDERPAL KAUR*** **and DHARMINDER SINGH**

**Department of Extension Education**
**Punjab Agricultural University, Ludhiana 141004 Punjab, India**
*Email for correspondence: narinderpalkaur2120@gmail.com

*© Society for Advancement of Human and Nature (SADHNA)* *Received: 11.06.2026/Accepted: 22.07.2026*

## BSTRACT

Agricultural knowledge management (AKM) plays a pivotal role in bridging the critical gap between scientific innovation and field-level implementation, particularly in developing economies like India. Despite agriculture serving as the primary source of livelihood for a substantial portion of the population, systemic issues, such as limited access to timely, actionable advisories, continue to constrain agricultural productivity and rural income growth. This paper examines the transformative potential of information and communication technologies (ICTs) in streamlining the four core stages of AKM: knowledge creation, storage, dissemination and utilization. By integrating modern digital tools, including mobile applications, web portals, satellite imagery and decision support systems, with traditional extension frameworks, agricultural stakeholders can facilitate rapid, bidirectional information flow between researchers and farming communities. However, realizing the full potential of ICT-driven AKM requires overcoming persistent bottlenecks, such as rural digital infrastructure deficits, low technical literacy, high device costs, content localization gaps and socio-economic exclusion. This paper provides a comprehensive review of existing public, private and non-governmental ICT initiatives in Indian agriculture, highlighting how hybrid extension models, capacity-building programmes and supportive policy frameworks can drive sustainable, inclusive and scalable knowledge management systems.

**Keywords:** Agricultural knowledge management (AKM); Information and communication technology (ICT); Agricultural extension; Digital agriculture

## INTRODUCTION

Knowledge management (KM) is the structured process of capturing, organizing, sharing and effectively using knowledge to benefit organizations and communities (Basyar et al 2025, Kalita and Deka 2024, Gonzalez and Martins 2017). Knowledge can be either formal (explicit) or informal (tacit). When knowledge is supported by scientific data that can be verified over time, it is considered formal (Khatri et al 2024, Jangir et al 2024).

The need for KM arises from the growing demand for quick access to accurate information, improved decision-making and the promotion of innovation and adaptability within organizations (Samadder and Rao 2023, Pavan et al 2019). To ensure effective KM, the integration of information and communication technology (ICT) is essential (Koyani et al 2025).

India's agricultural sector is currently facing significant challenges. Due to a lack of strategic focus, inadequate land reforms, poor land management, uncompetitive pricing for farm produce and insufficient investment in irrigation and infrastructure, India is heading toward an agricultural emergency (Singh et al 2015, Behera et al 2024).

ICTs play a transformative role in agricultural knowledge management (AKM) by enhancing the generation, storage, dissemination and application of agricultural knowledge. ICT encompasses a wide range of technical tools for managing information and facilitating communication, including computer hardware, network infrastructure, communication

middleware and necessary software (Pal et al 2020, Ram et al 2024). Furthermore, ICT includes diverse digital tools and systems designed to create, process, store and disseminate information, such as mobile phones, internet platforms, geographic information systems (GIS), drones and artificial intelligence (Bhat et al 2024). Farmers, extension workers and policymakers now have a wealth of tools and applications at their disposal, enabling them to make informed decisions for increased agricultural productivity and sustainability. In addition, timely hiring and the provision of adequate logistics should improve the delivery of agricultural extension services (Eastwood et al 2019).

A primary advantage of ICT in agricultural extension is its ability to bridge the information gap between research experts and farmers. This seamless flow of information has shifted traditional farming approaches, empowering farmers to make informed decisions and adopt innovative practices (Sharma et al 2012). In the modern agricultural landscape, effective knowledge management is crucial for enhancing productivity, sustainability and resilience among farmers and stakeholders.

In developing countries, where access to formal agricultural education and extension services is often limited, ICTs bridge knowledge gaps and reduce information asymmetry (Warren 2002). Various ICT tools provide valuable insights into soil health, moisture levels and pest outbreaks, enabling precise interventions and improved resource management. Access to the right knowledge at the right time and place helps the farming community increase yield, productivity and income (Hamad 2018, Das 2022). Consequently, previously isolated farmers in remote areas can now access expert advice and guidance without leaving their fields (Kalita and Deka 2024).

Without access to modern agricultural knowledge and timely information, farming communities in developing nations risk remaining trapped in cycles of low productivity, food insecurity and poverty (Shah 2022). However, key challenges persist, including digital illiteracy, limited internet connectivity and the need for localized content. Addressing these barriers through inclusive policies and infrastructural development is vital for maximizing the potential of ICTs in AKM. El Bilali and Allahyari (2018) assert that ICT-based innovations can improve rural livelihoods and empower smallholder farmers in developing countries by enhancing connectivity and increasing access to accurate, timely agricultural information.

This paper aims to provide an understanding of the knowledge management process in agriculture, highlight various ICT tools and examine institutional initiatives aimed at driving continuous improvement.

**Knowledge management in agriculture**

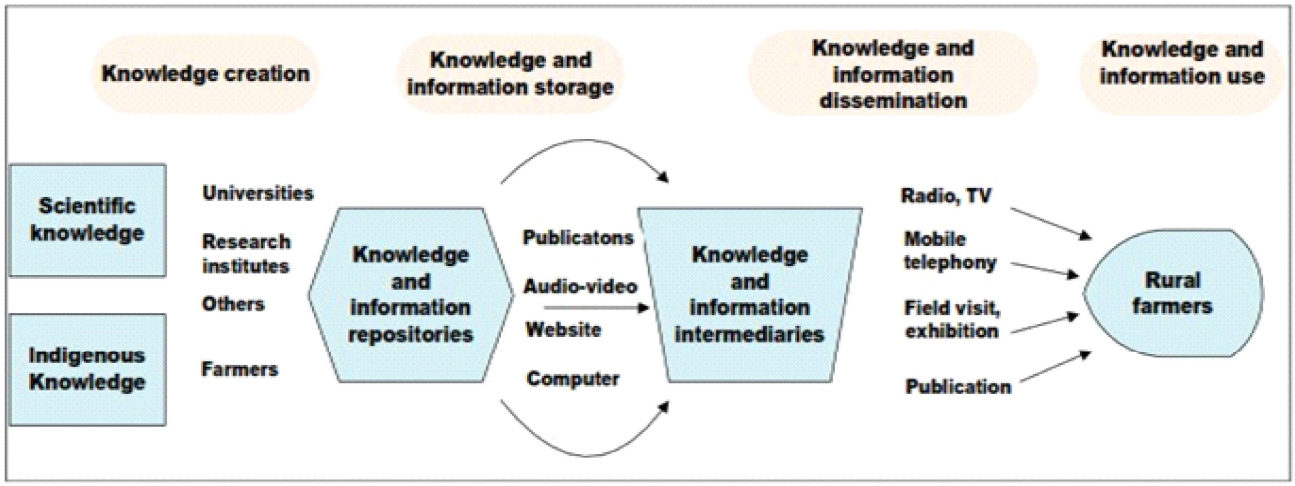
AKM is the process of generating, storing, disseminating and effectively utilizing knowledge to address current and future challenges in agricultural development (Kumar and Kalva 2015).

The process begins with knowledge creation, which encompasses both scientific knowledge and indigenous knowledge (Fig 1). Scientific knowledge is generated by universities, research institutions and other scientific organizations through formal research, experimentation and innovation. In contrast, indigenous knowledge is developed by farmers based on practical experience, traditional wisdom and location-specific farming practices. Both forms of knowledge are invaluable and together form the foundation of agricultural development (Dutta and Anand 2023, Vangala et al 2015).

Following creation, knowledge advances to the knowledge and information storage stage, where it is systematic collected, organized and preserved in knowledge repositories (Das 2022, Rafea 2009). These repositories serve as central storage units and can exist in physical or digital formats.

Agricultural knowledge is retained through publications, audio-visual materials, websites and computer-based databases (Kukreja and Chakrabarti 2013). Proper storage ensures that valuable insights are preserved and remain accessible for future reference and broader utilization.

The subsequent stage is knowledge and information dissemination, where stored knowledge is transferred to end-users via knowledge and information intermediaries (Yadav et al 2015). These intermediaries, including agricultural extension personnel, government departments, media agencies and non-governmental organizations, bridge the gap between research institutions and farming communities. They leverage multiple communication channels, such as radio, television, mobile telephony, field visits,




Source: https://www.researchgate.net/publication/354143393_Agriculture_Development_Through_Online_Web-based_Agro_Advisory_System_in_Rwanda

**Fig 1. Flow of scientific and indigenous knowledge to rural farmers**

exhibitions and print publications, to simplify and deliver actionable information that farmers can easily interpret and apply (Kumar and Kalva 2015, Khatri et al 2024).

The final stage is knowledge and information use, where rural farmers receive and apply the disseminated information in their daily agricultural operations. The effective utilization of agricultural knowledge enhances crop productivity, improves farm income and promotes long-term agricultural sustainability. Ultimately, knowledge management in agriculture is a continuous, interactive ecosystem that links research entities, information systems, extension networks and farmers, ensuring that impactful knowledge reaches the grassroots level to drive agricultural development (Vangala et al 2015).

**Status of ICT in Indian agriculture**

In India, over a billion people rely heavily on agriculture, which contributes between 60 and 70 per cent of their total household income. A primary factor constraining the nation's agricultural productivity is the persistent lack of timely and relevant information available to local farmers (Kukreja and Chakrabarti 2013). Over the past four decades, radio and television were the predominant ICT tools used to broadcast agricultural production methods and basic market updates. In recent years, however, modern digital technologies, such as mobile phones, portable devices, web-based portals, mobile applications, SMS services and satellite imagery, have dramatically transformed the nation's overall agricultural information landscape (Benson 2022, Nepal et al 2025).

ICT has significantly enhanced communication among diverse stakeholders, rendering agricultural research and development processes more inclusive. It fosters greater collaboration and facilitates both the vertical and horizontal integration of information across various agricultural entities (Ballantyne et al 2010, Saidu et al 2017).

Notably, the Indian Council of Agricultural Research (ICAR) has spearheaded key initiatives in this direction, including the digitization of libraries and the establishment of virtual Krishi Vigyan Kendras (KVKs) to digitally connect agricultural research and extension institutes.

These initiatives expand the collective knowledge base of domain experts by streamlining dialogue and knowledge sharing (Vangala et al 2015, Shah 2022, Asnamawati et al 2024). Ultimately, ICTs have proven indispensable in agricultural extension and advisory services, as these technologies enable effective engagement with farming families, a vital step toward boosting productivity, securing food supplies and bolstering rural livelihoods (Warren 2002, Kale et al 2015).

**Knowledge management tools**

Various ICT tools are currently utilized to share precise, accurate information across diverse channels, effectively eliminating geographical constraints (Zade et al 2024). These tools can be broadly classified into categories such as electronic devices, software applications and networking technologies (Table 1).

**Initiatives to promote ICT in AKM**

Major initiatives that are taken by various agencies to promote ICT in agriculture are given in Table 2.

**Benefits of ICT in AKM**

ICTs have fundamentally transformed how individuals, governments and organizations operate in the modern world. ICTs have been widely adopted to enhance communication and deliver vital services and information to communities that previously lacked access (Javeed et al 2020). The primary benefits include:

**Improved access to timely and relevant information**: ICT tools, such as mobile applications, SMS services, web portals and e-extension platforms, provide farmers with real-time updates on weather forecasts, pest outbreaks, optimal input usage, market prices and modern agronomic practices. This real-time access facilitates swift, informed decision-making, enabling farmers to adapt their field operations rapidly to changing conditions (Khatri et al 2024).

**Enhanced knowledge sharing and collaborative learning:** Digital platforms, including social media networks, messaging groups and online farming communities, foster peer-to-peer learning among farmers as well as direct interaction with extension agents. These virtual communities allow users to exchange practical solutions, share experiences and adopt innovations faster than traditional, face-to-face extension methods allow (Khatri et al 2024, Byamukama et al 2025).

**Cost-effective and scalable knowledge dissemination:** ICT significantly lowers the cost of delivering advisory services compared to traditional extension models, which rely heavily on physical travel, printed materials and repeated in-person visits. Digital networks allow agricultural institutions to broadcast localized advisories to thousands of farmers simultaneously at a fraction of the cost (Das 2022).

**Increased inclusivity and broadened reach:** ICT tools can penetrate remote and geographically isolated regions where traditional agricultural extension services are constrained or entirely absent. This expanded reach is vital for smallholder farmers and marginalized communities who have historically been excluded from formal agricultural knowledge systems (Kalita and Deka 2024).

**Decision support and effective risk management:** Decision support systems (DSSs) and ICT-driven advisories strengthen strategic farm planning by delivering precise, location-specific recommendations. This enables farmers to optimize input application, lower production risks and increase overall resource efficiency (Behera et al 2024).

Table 1. Overview of digital and communication tools in agriculture and extension

| Domain | Core applications and devices |
|---|---|
| Electronic gadgets | Radio, television, mobile phones, computer |
| Software/Apps | YouTube, WhatsApp, SMS, Android agriculture-related Apps |
| Networking technologies and others | Google chrome, Internet, Kisan Call Center, Village Knowledge Centre (VKC), MediaWiki, WordPress, Webinars, Webcasts, Podcasting, Videoconferencing |

Table 2. Major ICT initiatives in agricultural knowledge management

| Key sector/initiative classification | Prominent programmes and platforms |
|---|---|
| Government initiatives to promote ICT in AKM | AGRISNET, eKrishi, Agmarknet, Kisan Call Centre (KCC), EARIK, Digital Mandi, e-Agri Kiosk, Agri App, Agri Smart, Fertilizer Calculator, My RML, Kisan Yojana, Kisan Books |
| Non-government initiatives to promote ICT in AKM | Digital Green, MSSRF Fisher Friend (FFMA), Fisher Friend Mobile Advisory |
| Cooperative/private sector initiatives to promote ICT in AKM | eSagu, Warana, mKrishi, Gyandoot, IKSL, iKisan, Akashganga, aAQUA, Mahindra Kisan Mitra, Haryali Kisan Bazar, Reuters Market Light, e-Choupal |

**Strengthened knowledge retention and digital repositories:** ICT allows for the systematic storage, categorization and retrieval of agricultural information through digital databases, e-libraries, cloud systems and centralized knowledge portals. This infrastructure ensures effective knowledge preservation, safeguarding past research and practical insights for long-term utilization (Lahiri et al 2017).

**Market integration and value chain linkages:** Digital platforms grant farmers real-time market price visibility and connect them directly with potential buyers. This increased transparency enhances their bargaining power, decreases reliance on traditional intermediaries and bridges knowledge gaps across the entire agricultural value chain, from production to commercialization (Anand et al 2022).

**Early warning systems (EWSs) for disaster management:** ICTs supply communities and government bodies with accurate, real-time data crucial for disaster preparedness and risk mitigation. By delivering timely guidance before and during extreme events, these tools streamline emergency responses and foster resilient communication networks (Vangala et al 2015).

**Challenges in using ICT in AKM**

Despite its transformative potential, the integration of ICT into AKM faces several persistent challenges:

**Digital infrastructure deficits:** A primary hurdle in rural sectors is the lack of robust ICT infrastructure. Inadequate internet connectivity, limited broadband coverage and unreliable networks significantly restrict the reach and overall effectiveness of ICT-based knowledge services (Behera et al 2024, Ballantyne et al 2010, Nepal et al 2025).

**Low digital and technical literacy:** Many smallholder farmers and extension agents lack the technical skills required to operate smartphones, navigate specialized agricultural applications and utilize web portals effectively (Pavan et al 2019).

**High cost of ICT devices and services:** The expenses associated with purchasing and maintaining devices, such as smartphones and computers, alongside recurring internet data costs can be financially prohibitive for resource-poor farmers, thereby, limiting technology adoption (Javeed et al 2020, Kale et al 2015).

**Content relevance and localization issues:** A significant portion of digital agricultural content remains overly generic. ICT platforms often fail to account for site-specific agricultural conditions, local crop varieties, regional languages and socio-cultural contexts (Koyani et al 2025).

**Institutional and policy constraints:** Inadequate policy frameworks, insufficient public and private investment and poor inter-institutional coordination frequently hinder the seamless integration of ICT into existing AKM systems (Singh et al 2015).

**Resistance to change and social barriers:** Socio-cultural dynamics, including technophobia, a preference for traditional farming practices and skepticism toward new technologies, impede the widespread adoption of ICT solutions among farming communities (Zade et al 2024, Basyar et al 2025).

**Lack of training and support for extension personnel:** Extension workers often receive insufficient training on how to leverage and demonstrate modern ICT tools. This gap compromises their capacity to serve as effective knowledge intermediaries in the field (Hamad 2018, Kukreja and Chakrabarti 2013).

**Economic and financial barriers:** Due to constrained income levels, smallholder farmers often prioritize basic agricultural inputs over ICT equipment, connectivity subscriptions or paid advisory services, which further widens the rural digital divide (Koyani et al 2025, Behera et al 2024).

**Sustainability and maintenance challenges:** Even when ICT initiatives are successfully deployed, a lack of ongoing technical support, software updates and hardware maintenance services compromises the long-term viability and usability of these digital tools (Anand et al 2022, Dutta and Anand 2023).

**Gender and social inclusion gaps:** Disparities in access to ICT resources persist due to underlying socio-economic inequalities. Women and marginalized social groups frequently face restricted access to digital devices and information platforms, hindering the overall inclusivity of agricultural knowledge systems (Shah 2022, Saidu et al 2017).

**Strategies for efficient use of ICT in AKM**

To maximize the impact of ICTs in AKM systems, several strategic measures should be implemented:

**Establish and strengthen ICT-enabled knowledge repositories and digital platforms:** Well-structured digital repositories and agricultural knowledge portals should be established and maintained to integrate research outputs, validated best practices and indigenous knowledge. These centralized hubs enhance accessibility, allowing stakeholders to search, retrieve and apply relevant information efficiently (Khwidzhilli et al 2025, Khatri et al 2024).

**Enhance digital literacy and build technical capacity across rural communities:** Public and private stakeholders must invest in continuous capacity-building initiatives and training programmes designed for both farmers and extension personnel. Improving digital skills enables end-users to effectively leverage ICT tools to access information, interpret technical data and make informed decisions (Singh et al 2025, Vangala et al 2015).

**Integrate modern ICT tools with traditional agricultural extension services:** Combining digital platforms with traditional, face-to-face extension methods helps maximize outreach while reinforcing system credibility. These hybrid extension models overcome barriers related to trust and digital literacy gaps, thereby, encouraging the sustained adoption of ICT tools in agricultural fields (Koyani et al 2025).

**Improve rural ICT infrastructure and increase digital accessibility:** Governments and telecom providers need to expand stable internet connectivity, ensure affordable data pricing and increase access to digital devices in rural areas so that ICT initiatives reach the broadest possible audience. Robust infrastructure investment is foundational for supporting seamless, long-term knowledge management integration in AKM systems (Aranguri et al 2025, Ram et al 2024).

**Promote mobile applications and social media platforms for rapid knowledge sharing:** Agricultural institutions should leverage widespread mobile technologies, such as WhatsApp groups, SMS advisories and social media networks, to deliver localized, time-sensitive information. These platforms support high adoption rates and foster interactive, two-way communication between farmers and subject-matter experts (Byamukama et al 2025, Kalita and Deka 2024).

**Tailor digital content using interactive decision support tools:** Research entities and tech developers must create and integrate decision support systems (DSSs), location-specific advisories, real-time weather forecasts and market price alerts tailored to local agro-climatic conditions. Providing actionable, context-specific insights enhances the practical value of information for farm management decisions (Samadder and Rao 2023, Benson 2022).

**Encourage strong policy support and sustained funding for ICT in AKM:** Stakeholders must advocate for supportive policy frameworks, dedicated funding mechanisms and public-private partnerships to ensure the long-term sustainability and scalability of digital agriculture initiatives. Strong policy backing is essential to address institutional fragmentation and streamline ICT-AKM efforts (Koyani et al 2025).

## CONCLUSION

The transition toward a resilient, productive and sustainable agricultural sector hinges on how effectively knowledge is generated, preserved and communicated to farming communities. Information and communication technologies (ICTs) have emerged as indispensable instruments in modernizing agricultural knowledge management (AKM), dismantling geographical barriers and enabling real-time delivery of location-specific, actionable advisories.

From empowering extension workers with mobile applications to establishing centralized digital repositories and market linkage platforms, ICT interventions have significantly narrowed the gap between scientific innovation and traditional farming practices.

Nevertheless, ICTs cannot serve as a standalone panacea. The persistence of digital divides, infrastructure gaps, content localization challenges and socio-economic inequities underscores the need for a balanced, inclusive approach. Future progress lies in strengthening hybrid extension architectures that blend cutting-edge digital platforms with direct, face-to-face human interactions. Sustained investments in rural digital infrastructure, target-driven digital literacy campaigns, robust public-

private partnerships and policy frameworks focused on social inclusion will ensure that the benefits of digital agriculture reach smallholders and marginalized farmers alike. By building an interactive, user-centered knowledge ecosystem, ICT-enabled AKM can drive long-term rural livelihoods, food security and agricultural growth.

## REFERENCES


Anand S, Prakas S and Singh AK 2022. Determinants of ICT tools accessibility by farmers in Bihar. Indian Journal of Extension Education **58(3):** 186-189; doi: 10.48165/IJEE.2022.58338.

Arangurí M, Mera H, Noblecilla W and Lucini C 2025. Digital literacy and technology adoption in agriculture: a systematic review of factors and strategies. AgriEngineering **7(9):** 296; doi: 10.3390/agriengineering7090296.

Asnamawati L, Herawati IE, Yuliawati and Nurmalia A 2024. Cyber extension: information technology and agricultural development (systematic literature review). Jurnal Agroqua **22(2):** 89-109; doi: 10.32663/ja.v21i2.4810.

Ballantyne P, Maru A and Porcari EM 2010. Information and communication technologies – opportunities to mobilize agricultural science for development. Crop Science **50(S1):** S63-S69; doi: 10.2135/cropsci2009.09.0527.

Basyar B, Tanjung HB, Azrifirwan and Novitasari S 2025. Utilization of information and communication technology (ICT) in improving the performance of agricultural extension workers and disaster management in Agam Regency, West Sumatra province. In: E3S Web of Conferences (A Hakam, Fauzan, ASA Rashid and S Sabbarayan, Eds), 3rd International Conference on Disaster Mitigation and Management (3rd ICDMM 2025), 29-30 September 2025, Padang, West Sumatra, Indonesia, **677:** 04002; doi: 10.1051/e3sconf/202567704002.

Behera A, Makeni C, Sangtam L and Ranjan R 2024. Use of information communication technology in agricultural marketing: a study from Odisha. Education and Society **48(2-2):** 54-60.

Benson T 2022. ICT supported, agricultural extension and advisory services in Ethiopia. International Journal of Academic Pedagogical Research **6(7):** 123-127.

Bhat PP, Prasad RR, Anil K, Jadhav A, Manohar KN, Rajesh CM and Reddy SL 2024. The role of information and communication technology in enhancing the effectiveness of agricultural extension programmes worldwide: a review. Journal of Scientific Research and Reports **30(7):** 963-976; doi: 10.9734/jsrr/2024/v30i72206.

Byamukama W, Ssemakula E, Ssekandi J, Shaman A, Businge P, Kalibwani R, Atukunda C and Turyasingura B 2025. A review of ICT integration in agricultural extension services: a global perspective. East African Journal of Agriculture and Biotechnology **8(1):** 292-312 doi: 10.37284/eajab.8.1.849.

Das G 2022. Role of ICTs in agriculture knowledge management. Just Agriculture **3(2):** 1-20.

Dutta M and Anand K 2023. Role of information communication technology in agriculture. International Journal of Novel Research and Development **8(10):** a863-a870.

Eastwood C, Klerkx LM, Ayre and Dela Rue B 2019. Managing socio-ethical challenges in the development of smart farming: from fragmented to a comprehensive approach for responsible research and innovation. Journal of Agricultural and Environmental Ethics **32:** 741-768; doi: 10.1007/s10806-017-9704-5.

El Bilali H and Allahyari MS 2018. Transition towards sustainability in agriculture and food systems: role of information and communication technologies. Information Processing in Agriculture **5(5):** 456-464; doi: 10.1016/j.inpa.2018.06.006.

Gonzalez RVD and Martins MF 2017. Knowledge management process: theoretical-conceptual research. Gestao and Producao **24(2):** 248-265; doi: 10.1590/0104-530X0893-15.

Hamad WB 2018. The role of ICT in knowledge management processes: a review. International Journal of Engineering Science and Computing **8(3):** 16373-16380.

https://www.researchgate.net/publication/354143393_Agriculture_Development_Through_Online_Web-based_Agro_Advisory_System_in_Rwanda

Jangir S, Gurjar K, Pandey S and Mishra S 2024. Knowledge management in agricultural extension: sharing, documenting, utilizing of knowledge in agricultural extension. In: Current trends in agriculture and allied sciences, Volume 2 (M Sehgal, S Borah, R Verma, SD Behera, Y Pandey, C Ravindran, A Shukla, A Singh and B Rajasekar, Eds), SP Publishing, Bhubaneswar, Odisha, India, pp 523-531.

Javeed I, Narayan S, Malik AA, Kumar A, Rahman R, Nisar S, Akhter A, Indrabi SA and Sultan A 2020. Role of information and communication technology in agriculture. International Journal of Current Microbiology and Applied Sciences **11(Special Issue):** 2028-2037.

Kale RB, Rohilla PP, Meena MS and Wadkar SK 2015. Information and communication technologies for agricultural knowledge management in India. Journal of Global Communication **8(1):** 16-22; doi: 10.5958/0976-2442.2015.00002.6.

Kalita R and Deka N 2024. Factors affecting utilization of information and communication technology (ICT) in agricultural sector: a case study in upper Brahmaputra valley zone of Assam, India. Asian Research Journal of Agriculture **17(2):** 1-7; doi: 10.9734/arja/2024/v17i2411.

Khatri A, Lallawmkimi MC, Rana P, Panigrahi CK, Minj A, Koushal S and Ali MU 2024. Integration of ICT in agricultural extension services: a review. Journal of Experimental Agriculture International **46(2):** 394-410; doi: 10.9734/jeai/2024/v46i123146.

Khwidzhilli RH, Ijatuyi EJ and Diko P 2025. The role of information and communication technologies in enhancing farmers' access to extension services: evidence from Ingquza Hill Local Municipality. Frontiers in Sustainable Food Systems **9:** 1704550; doi: 10.3389/fsufs.2025.1704550.

Koyani BK, Prajapati PV, Patel GR and Dalvi VD 2025. Strengthening agricultural extension through knowledge management: strategies for recording, exchanging and applying information. Just Agriculture **5(7):** 187-194.

Kukreja A and Chakrabarti B 2013. Agricultural knowledge management and dissemination: initiatives by information and communication technology. Journal of Global Communication **6:** 51-58; doi: 10.5958/j.0976-2442.6.1.006.

Kumar AA and Kalva UK 2015. Knowledge management: a review. International Journal of Academic Research in Social Sciences and Humanities **1(1):** 9-17.

Lahiri B, Borah S, Marak NR and Anurag TS 2017. Development of mobile phone-based agro-advisory system through ICT mediated extension approach in northeastern Himalayan region of India. Journal of Applied and Natural Science **9(3):** 1808-1814; doi: 10.31018/jans.v9i3.1443.

Nepal AK, Choudhary D, Pandit NR and Khanal N 2025. Impact of training and digital extension services on agricultural technology adoption and rice yields. PLoS One **20(12):** 1-27. 10.1371/journal.pone.0337456.

Pal A, Singh D and Dhaliwal RK 2020. Identification and relevance of e-readiness assessment tools for ICT use in agriculture. Current Journal of Applied Science and Technology **39(16):** 93-102; doi: 10.9734/CJAST/2020/v39i1630741.

Pavan MK, Devegowda SR, Kumari K and Kushwaha S 2019. Role of ICT in agriculture. Agrobios Newsletter. **17(10):** 127-128.

Rafea A 2009. Managing agriculture knowledge: role of information and communication technology. In: Thinkpiece for CGIAR Science Forum Workshop on ICTs Transforming Agricultural Science, Research and Technology Generation, 16-17 June 2009, Wageningen, Netherlands.

Ram L, Singh HC, Vyas D, Shukla MP, Nayan G and Sagar M 2024. From soil to screen: how mobile apps and e-portals are transforming indian agriculture. In: Organic and eco-friendly farming: practices and techniques (J Singh, R Nigam, S Koushal, V Jain and A Kumar, Eds), Biotech Books, New Delhi, India, pp 97-109.

Saidu A, Clarkson AM, Adamu SH, Mohammed M and Jibo I 2017. Application of ICT in agriculture: opportunities and challenges in developing countries. International Journal of Computer Science and Mathematical Theory **3(1):** 8-18.

Samadder S and Rao D 2023. Role and importance of ICT in agricultural extension. In: Recent trends in agriculture (S Thakur, R Sood, R Chawla, C Kiran and N Sheoran, Eds), Integrated Publications, New Delhi, India, pp 201-214.

Shah D 2022. Role of information and communication technology in agricultural development of India. Review of Market Integration **14(2-3):** 113-132; doi: 10.1177/09749292221119286.

Sharma M, Kaur G and Gill MS 2012. Use of information and communication technology in agriculture by farmers of district Kapurthala. Journal of Krishi Vigyan **1(1):** 83-89.

Singh M, Bhanotra A, Niketha L, Wani SA and Kumar M 2015. Mobile phone technology – an eminent ICT tool for better family farming. In: Family farming and rural economic development (ML Choudhary and Aditya, Eds), New India Publishing Agency, New Delhi, India, pp 287-291.

Singh P, Singh N, Meena NR and Patel R 2025. Role of ICTs in agricultural knowledge management. New Era Agriculture Magazine **4(5):** 18-24.

Vangala RNK, Mukerji M and Hiremath BN 2015. ICTs for agriculture knowledge management: insights from DHRUVA, India. In: ICTD'15: Proceedings of the Seventh International Conference on Information and Communication Technologies and Development, 15-18 May 2015, Singapore; doi: 10.1145/2737856.2737863.

Warren MF 2002. Adoption of ICT in agricultural management in United Kingdom: the intra-rural digital divide. Agricultural Economics – Czech **48(1):** 1-8; doi: 10.17221/5280-AGRICECON.

Yadav K, Sulaiman R, Yaduraju NT, Balaji V and Prabhakar TV 2015. ICTs in knowledge management: the case of the Agropedia platform for Indian agriculture. Knowledge Management for Development Journal **11(2):** 5-22.

Zade S, Sharma ML and Chinchmalatpure UR 2024. Exploring the determinants of the extent of ICT tools utilization among agricultural research scholars. Gujarat Journal of Extension Education **38(1):** 121-129; doi: 10.56572/gjoee.2024.38.1.0021.

***How to cite this article:*** Kaur N and Singh D 2026. Transforming agricultural knowledge management through information and communication technology (ICT): opportunities, challenges and strategies. Int J Farm Sci 16(4): 10-18; doi: 10.5958/2250-0499.2026.00028.5.