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# Empowering Rural Women in Indian Agriculture throughICT

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**ABSTRACT**

The present study examines the increasing significance of Information and Communication Technology (ICT) in rural India, with particular emphasis on its tools, applications, and contribution to empowering rural women engaged in agriculture. ICT tools such as mobile phones, basic communication networks, and digital platforms have emerged as accessible and practical sources of information for rural women farmers. These technologies enable them to receive agricultural advisories, technical updates, and essential messages directly, reducing reliance on traditional extension services.In recent years, services such as online banking, digital governance, e-markets, and distance-learning platforms have helped overcome long-standing challenges related to geographical isolation and social constraints in rural areasICT-based extension services have further improved the dissemination of agricultural knowledge. Mobile-based advisories, online platforms, and digital applications have enhanced farm productivity and created new income-generating opportunities for rural families. Although traditional media such as radio and television continue to play a role, India has increasingly promoted ICT-enabled agricultural initiatives, including community information centers at the village level.Despite these advancements, the adoption of ICT remains uneven across regions. Economically and technologically advanced areas benefit more from ICT integration, while less-developed regions continue to face challenges such as poor connectivity, limited infrastructure, and low digital literacy, By improving access to information and capacity-building resources, ICT helps women emerge as active contributors, innovators, and role models within the agricultural sector (Rani, 2023; Kumar & Singh, 2025).

## Introduction

### 1. Background and Rationale:

Agriculture continues to be the primary source of livelihood for rural households in India, with women comprising nearly **33–48% of the agricultural workforce** (FAO, 2019; Government of

India, 2021). Despite their significant contribution, women still face several structural constraints, including limited land ownership, restricted mobility, and inadequate access to technology and information systems (Agarwal, 2020; Reddy & Mishra, 2022).Over the last decade, ICT has emerged as a powerful instrument for reducing gender-based inequalities by strengthening women's access to information, extension services, and economic opportunities (Singh &Meera, 2014; Sharma et al., 2021). The rapid spread of mobile phones, expansion of rural internet connectivity, and government-backed digital agriculture platforms have accelerated ICT adoption in rural areas (MeitY, 2022).Instruments such as **remote sensing**, **Decision Support Systems (DSS)**, **Kisan Call Centers**, **community knowledge kiosks**, and **AI-enabled advisory services** have shown considerable potential to improve extension delivery, enhance women's access to timely information, and enable both social and economic empowerment (Goyal&Tripathi, 2020; Verma& Joshi, 2023).

## 2. Status of Indian Agriculture and the Need for ICT:

Indian agriculture is currently experiencing multiple challenges, including **productivity stagnation**, climate uncertainties, limited irrigation coverage, fragmented landholdings, and weak market linkages (Chand, 2020; ICAR, 2022). Growing population pressures have further widened the gap between food demand and agricultural output.ICT has emerged as a viable solution for bridging these systemic gaps by enabling real-time decision-making, expanding access to extension information, improving market integration, and simplifying access to government schemes and financial services (Rao &Rathod, 2022; Sharma &Babu, 2020)

## Major Challenges in Indian Agriculture and ICT-Based Solutions:

| Challenges in Indian Agriculture | ICT-Enabled Solutions | Citations |
|---|---|---|
| **Low productivity** | DSS tools, weather apps, crop advisory platforms | ICAR (2022); Meera et al. (2018); Sharma et al. (2021) |
| **Poor market access** | e-Choupal, AGMARKNET, mobile price alerts | Goyal (2010); MoA&FW (2023); FAO (2021) |
| **Climate risks** | Satellite-based early warning systems | IMD (2022); Rao &Rathod (2022); FAO (2021) |
| **Lack of extension coverage** | Kisan Call Centers (KCC), WhatsApp advisory groups | Meera&Jhamtani (2018); MoA&FW (2023); Verma& Joshi (2023) |
| **Limited financial inclusion** | Mobile banking, DBT portals, | MeitY (2022); RBI (2021); |

| | | |
|---|---|---|
| | electronic payment systems | Kumar &Babu (2020) |
| **Gender inequality** | ICT training for women SHGs, digital literacy programmes | Agarwal (2020); Thakur & Singh (2022); Rani (2023) |

## Role of ICT across Different Dimensions of Agricultural Development:

| Dimension | ICT Intervention | Contribution |
|---|---|---|
| **Production** | Weather apps, DSS tools, e-Sagu, crop advisory SMS | Timely decisions, reduced losses |
| **Marketing** | e-Chaupal, Agmarknet, mobile price alerts | Better market access & fair pricing |
| **Extension** | KVK portals, KCCs, online trainings | Increased knowledge & technology adoption |
| **Finance** | Digital payments, e-banking, mobile wallets | Direct benefit transfers & financial inclusion |
| **Women Empowerment** | WhatsApp groups, online SHG platforms, digital literacy apps | Skill development & leadership |

(Meera et al., 2018; Patel, 2023)

## 3. Concept of ICT and e-Agriculture:

Information and Communication Technology (ICT) refers to a wide range of digital tools and technologies used for **data storage, processing, retrieval, and communication**. ICT includes hardware, software, internet services, and digital platforms that help farmers' access timely and reliable agricultural information (Richardson, 2006; Rao, 2019).The concept of **e-Agriculture** focuses on integrating these digital tools to improve agricultural productivity, enhance rural development, and strengthen communication between farmers and extension systems (World Bank, 2020; Meera&Jhamtani, 2018). It enables faster information flow, data-driven decisions, and wider access to advisory services—especially for remote and underserved rural communities

**ICT in Agriculture**

- ├── Mobile Phones & Smart Apps
- ├── e-Governance Portals
- ├── DSS & Expert Systems
- ├── GIS, GPS & Remote Sensing

├── Agri-Kiosks & Community Centers
├── AI-Based Crop Advisory Tools
└── Digital Market Platforms

## 4. ICT Penetration in Rural India:

Over the past decade, India has emerged as one of the world's leading adopters of ICT-driven development programmes. Reports indicate that India now accounts for **over 45% of global ICT-based rural development initiatives**, supported by strong government policies and expanding digital infrastructure (NITI Aayog, 2018; FAO, 2021). The rapid rise in rural mobile connectivity, availability of low-cost smartphones, and expansion of broadband services have significantly strengthened digital penetration across villages (MeitY, 2022).

Despite this progress, digital penetration among women still faces challenges such as limited device ownership, lower digital literacy, and socio-cultural restrictions (Thakur & Singh, 2022; Agarwal, 2020). These factors highlight the need for targeted, gender-sensitive ICT interventions.

### Major ICT Initiatives for Rural Agriculture in India

| ICT Initiative | Implementing Agency | Target Users | Key Services Provided | Impact on Rural Women |
|---|---|---|---|---|
| **mKisan / SMS Portal** | Ministry of Agriculture, GoI | All farmers | SMS-based crop advisory, weather alerts, market prices | Enhances timely decision-making; easy access to information without mobility |
| **Digital India Mission** | MeitY, GoI | Rural population | Rural internet, digital literacy, e-governance | Improves access to digital resources for women and SHGs |
| **Common Service Centers (CSCs)** | CSC-SPV | Rural households | G2C services, DBT, insurance, PAN, telemedicine | Provides digital services near doorstep; boosts e-literacy among women |
| **Agrisnet** | NIC, State Agriculture Depts | Farmers | Input details, pest management, extension advisory | Supports women farmers with localized crop information |
| **e-Chaupal** | ITC Ltd. | Small farmers | Market linkages, procurement, price | Helps women producers gain better market |

| ICT Initiative | Implementing Agency | Target Users | Key Services Provided | Impact on Rural Women |
|---|---|---|---|---|
| | | | transparency | knowledge |
| **Kisan Call Centers (1800–180–1551)** | MoA&FW | All farmers | Expert agricultural advisory in local languages | Allows women to ask queries privately and conveniently |
| **Village Knowledge Centers (VKCs)** | MSSRF | Rural communities | Internet, agri-information, digital services | Local women trained as knowledge workers |
| **KisanSuvidha App** | MoA&FW | Smartphone users | Weather, prices, dealers, insurance | Women can check information without male intermediaries |
| **PM-KISAN Portal** | MoA&FW | All farmers | DBT transfer of ₹6000/year | Increases direct financial access for women beneficiaries |

Yet, the digital divide remains prominent. Women often face:

- Lower access to mobile phones
- Limited digital literacy
- Social restrictions on mobility
- Lower participation in formal extension activities

## 5. Gender Dimensions in ICT Intervention:

Women frequently remain outside the formal extension system due to household responsibilities, mobility restrictions, and socio-cultural barriers (Agarwal, 2020; Rani, 2023). ICT addresses this gap by bringing information directly to women through mobile phones, WhatsApp groups, interactive SMS services, and video-based learning platforms (Goyal, 2021; Patel, 2022).

## Differences in ICT Access Between Men and Rural Women:

| Indicators | Male Farmers | Rural Women |
|---|---|---|
| Access to Mobile Phones | High | Moderate |

| Indicators | Male Farmers | Rural Women |
|---|---|---|
| Digital Literacy | Moderate | Low |
| Extension Participation | High | Very Low |
| Market Information Access | High | Low |
| Decision-Making | Moderate | Low–Moderate |
| ICT-Based Empowerment Potential | High | High (if supported properly) |

(Singh &Meera, 2014; Rao, 2019)

## 6. ICT as a Tool for Women Empowerment:

ICT has become an important driver of women's empowerment in rural India by improving their access to information, financial services, and livelihood opportunities. Digital tools have helped bridge the long-standing gender gap in extension services, market access, and decision-making power within households and farming systems (Agarwal, 2020; Thakur & Singh, 2022).

ICT supports women's empowerment in several ways:

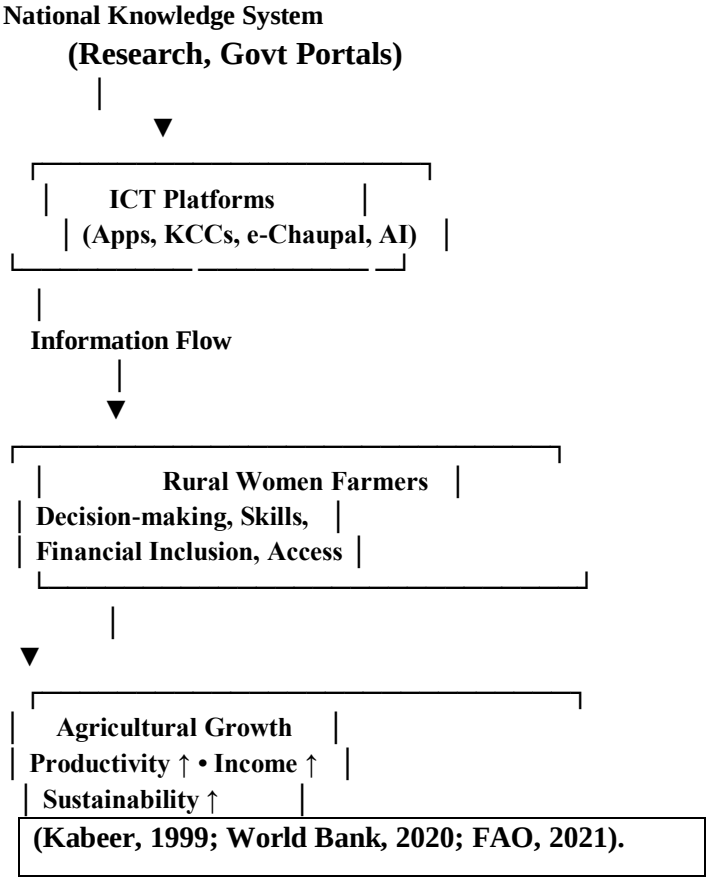
1. **Enhancing knowledge regarding crop management, pest and disease control, and fertilizer use**, allowing women to make informed decisions and manage farms more effectively (Sharma et al., 2021; ICAR-DKMA, 2023).
2. **Strengthening participation in household and farm-level decision-making**, as access to timely information increases women's confidence and bargaining power (Agarwal, 2020; Rani, 2023).
3. **Improving financial inclusion** through mobile banking, online transactions, and digital payment systems, enabling women to manage money directly and receive government benefits without intermediaries (MeitY, 2022; RBI, 2021).
4. **Providing entrepreneurial opportunities** in dairy, poultry, food processing, and SHG-based microenterprises by giving women access to market prices, training resources, and business information (Joshi, 2023; MoRD, 2022).
5. **Facilitating social empowerment** by enabling access to government schemes, legal rights information, and digital identity services through portals and CSCs (NITI Aayog, 2018; MoA&FW, 2023).

6. **Building confidence and digital capabilities** through ICT training programmes, digital literacy initiatives, and SHG-led capacity-building efforts (Thakur & Singh, 2022; MSSRF, 2021).

Overall, ICT acts as a catalyst that enhances women's knowledge, economic independence, social mobility, and participation in agricultural and community development.

## 7. Conceptual Framework: ICT → Empowerment → Agricultural Growth

**ICT Empowerment Model for Rural Women**



## 8. Trends of ICT Adoption Among Rural Women:

**ICT Adoption Level →**
**|■■■■■■■■■■■■■■■■■■■■■■ 2024**
**|■■■■■■■■■■■■■■■ 2020**
**|■■■■■■■■■ 2015**
**|■■■■ 2010**
**|_____ Time →**
(NSSO, 2022; MeitY, 2023).
This reflects rapid improvement in digital access among women due to smartphones and government digital missions.

## 9. Review of Major ICT Initiatives Targeting Women:

Several national ICT programmes have played a crucial role in enhancing digital access and skills among rural women. These initiatives focus on improving digital literacy, connectivity, agricultural knowledge, and access to government services, thereby strengthening women's participation in farming and livelihood activities.• **Digital SakshartaAbhiyan (DISHA)** – A nationwide programme aimed at improving digital literacy among rural households, enabling women to access online services, financial transactions, and agricultural information (MeitY, 2022).• **BharatNet** – India's largest rural broadband initiative designed to provide high-speed optical fiber connectivity to Gram Panchayats, significantly improving digital access for rural women (DoT, 2021).• **MahilaKisaanSashaktikaranPariyojana (MKSP)** – A sub-component of the National Rural Livelihoods Mission (NRLM) that integrates ICT tools for training, skill development, and farm-based livelihood enhancement among women farmers (MoRD, 2022).• **National e-Governance Plan in Agriculture (NeGP-A)** – A major digital agriculture mission that promotes unified ICT-enabled advisory services, including portals, mobile applications, and decision-support tools for farmers (MoA&FW, 2023).Collectively, these programmes are transforming rural women into **confident, informed, and economically independent agricultural stakeholders**, as digital tools expand their access to knowledge, markets, and government support systems (FAO, 2021; World Bank, 2020).

## .10. Summary

ICT has become an important force in changing the role of rural women in Indian agriculture. Digital tools used for extension services, market access, finance, and skill-building have improved women's independence, productivity, and social and economic status.In a rapidly

digitizing India, empowering women through ICT is not only an agricultural strategy but a holistic approach toward inclusive rural development.

## 11. Conclusion

Information and Communication Technology (ICT) has emerged as a critical catalyst for socio-economic development in rural India, particularly in enhancing the status of women engaged in agriculture. This review demonstrates that ICT interventions have significantly contributed to reducing persistent disparities in access to agricultural knowledge, markets, financial services, and extension support—domains in which rural women have historically faced exclusion (FAO, 2017; World Bank, 2019). By enabling timely and direct access to information, digital tools have strengthened women's confidence and increased their participation in household and farm-level decision-making processes.ICT adoption has also played a vital role in improving agricultural productivity by supporting informed decision-making related to crop management, efficient resource use, and risk mitigation (Aker, 2011). The expansion of digital financial services, including online banking, direct benefit transfers, and mobile payment systems, has enhanced women's financial autonomy and reduced their dependence on intermediaries (Rashid & Elder, 2009). These developments have enabled rural women to engage more actively in marketing, savings, and entrepreneurial activities. Furthermore, digital literacy programmes, online training initiatives, and ICT-enabled self-help group (SHG) platforms have facilitated skill development and promoted livelihood diversification beyond traditional farming practices (Mittal &Mehar, 2016).Despite these positive outcomes, significant challenges remain. Limited ownership of digital devices, low digital literacy levels, socio-cultural constraints, and uneven internet connectivity continue to restrict the effective use of ICT by rural women (GSMA, 2020). Additionally, the benefits of ICT adoption remain uneven, with greater impacts observed in regions possessing stronger educational and infrastructural capacities.

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