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# Digital Divide in E-Crop Adoption: Rural vs. Urban Farms

*Rita Fredericks
CEO, Precision Grow (A Unit of Tech Visit IT Pvt Ltd)
*Corresponding Author's email: rita@precisiongrow.co.in

The adoption of digital technologies in agriculture, often termed E-Crop adoption, is reshaping farm management, input optimization, and yield improvement. Despite significant advancements, the digital divide between rural and urban farms continues to hinder equitable benefits from these technologies. Rural farmers often face barriers such as limited internet connectivity, inadequate digital literacy, lack of access to devices, and socio-economic constraints, whereas urban and peri-urban farmers typically enjoy better infrastructure and resources. This article critically examines the factors contributing to the digital divide, its implications on farm productivity and sustainability, and strategies to bridge the gap. By understanding the disparities in E-Crop adoption, policymakers and stakeholders can formulate inclusive strategies to enhance digital inclusion in agriculture.

## Introduction

Agriculture has traditionally been a knowledge-intensive sector. The emergence of digital agriculture—using tools like precision farming apps, sensors, drones, GPS mapping, and e-market platforms—has enabled farmers to optimize resources, reduce costs, and improve yields. Platforms such as eKutir Krishi, Daksh Mobile, and various agricultural apps provide real-time guidance on weather, irrigation, pest management, and market prices.

Despite these advancements, adoption is uneven, with urban and peri-urban farms more likely to benefit from digital tools than remote rural farms. This digital divide threatens to exacerbate inequalities, reduce the resilience of rural farming systems, and limit the broader impact of technology-driven agricultural interventions. Understanding the socio-economic, infrastructural, and cultural factors behind this divide is crucial for promoting inclusive agricultural digitalization.

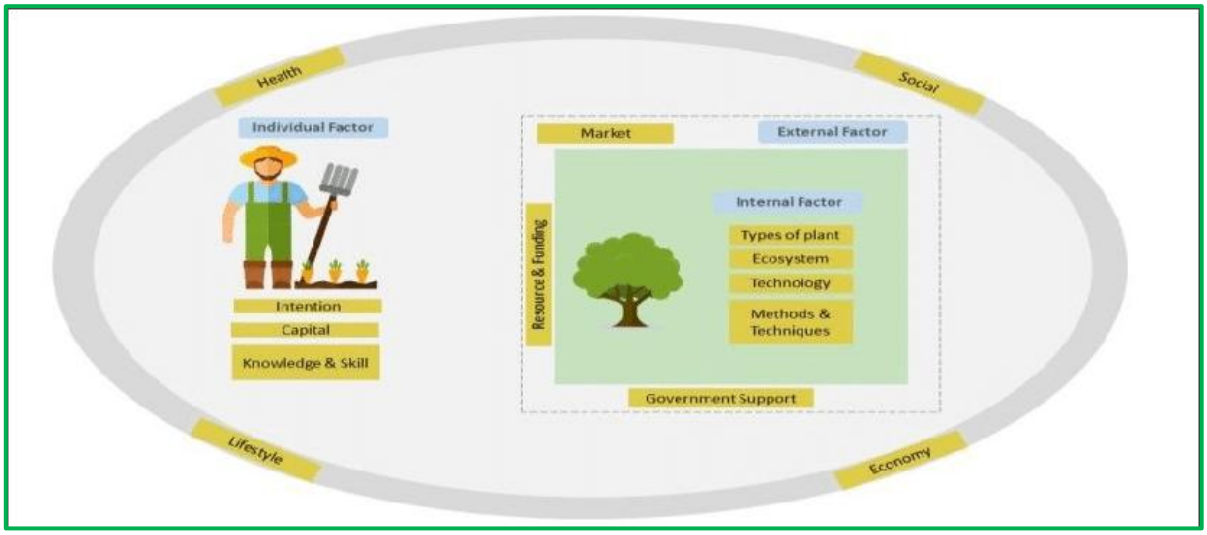
## Concept of Digital Divide in Agriculture

### Definition

The digital divide refers to the gap between individuals, communities, or regions in accessing, using, or benefiting from digital technologies. In agriculture, it denotes disparities in the adoption of E-Crop solutions mobile applications, digital advisory services, precision agriculture tools, and smart farm management systems.

### Dimensions of the Divide

- **Infrastructure Access:** Availability of broadband, mobile networks, electricity, and digital devices.
- **Digital Literacy:** Skills required effectively using digital applications and interpreting data.
- **Economic Capacity:** Ability to invest in smartphones, sensors, or software subscriptions.
- **Cultural Factors:** Resistance to change, traditional farming practices, and social norms.




Source: https://www.researchgate.net/

## Rural vs. Urban Farm Adoption

### Rural Farms

Rural farmers face multiple constraints in adopting E-Crop technologies:

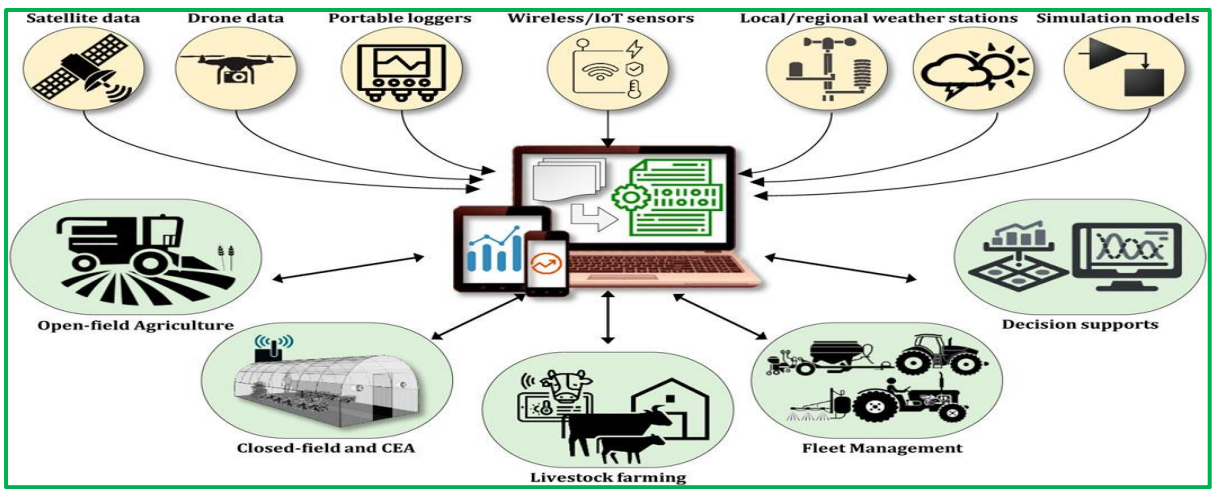
1. **Limited Connectivity:** Internet and mobile network coverage is often weak or inconsistent in remote villages.
2. **Low Digital Literacy:** Many farmers lack training to navigate applications or understand digital advisories.
3. **Financial Constraints:** Smartphones, IoT devices, and sensors may be unaffordable for smallholder farmers.
4. **Traditional Practices:** Reliance on conventional methods may reduce motivation to adopt new technologies.

Despite these challenges, studies have shown that training programs, government initiatives, and cooperative models can improve adoption rates when combined with local extension services.

### Urban and Peri-Urban Farms

Urban farms typically benefit from better infrastructure:

1. **High-Speed Internet:** Continuous access to apps, e-market platforms, and advisory services.
2. **Higher Literacy Rates:** Easier comprehension of technical information and instructions.
3. **Economic Resources:** Farmers can invest in IoT-enabled devices, sensors, drones, and precision irrigation.
4. **Access to Technical Support:** Close proximity to extension offices, universities, and private service providers.




Source: frontiersin.org/journals/environmental-science

## Factors Influencing the Digital Divide

### Socio-Economic Factors

- Landholding size, income, and access to credit affect the ability to adopt digital tools.
- Rural farmers often depend on small-scale subsistence farming, limiting their ability to invest in technology.

### Educational and Training Factors

- Literacy and exposure to technology directly impact adoption.
- Extension programs that provide hands-on training significantly improve technology uptake.

### Infrastructure and Policy Support

- Poor mobile network coverage, irregular electricity supply, and high device costs exacerbate the divide.
- Policy interventions like Digital India initiatives, subsidized devices, and e-extension programs aim to reduce these barriers.

### Cultural and Social Factors

- Older farmers may resist technology adoption due to tradition or lack of confidence.
- Community norms and peer influence shape the willingness to embrace digital solutions.

## Implications of the Digital Divide

**Productivity Gaps:** Limited access to E-Crop solutions may reduce crop yields, increase input wastage, and constrain efficiency.

**Market Inequities:** Farmers without digital access cannot fully leverage e-markets, limiting profitability.

**Knowledge Inequality:** Lack of real-time advisory services leads to lower awareness of pest outbreaks, weather risks, and best practices.

**Rural-Urban Disparities:** The divide exacerbates socio-economic inequality between rural and urban farm communities.

## Strategies to Bridge the Digital Divide

### Capacity Building and Training

Developing rural farmers' digital capacity is essential to embrace E-Crop adoption. Digital literacy programs must be designed to impart skills to farmers to effectively utilize mobile apps, sensors, and online advisory platforms. On-field demonstrations and hands-on workshops enable farmers to practice, learn through experience, and avoid the limitations of just following theoretical instructions. To make participation widespread, applications and learning materials should be in local languages and have simple interfaces, lowering the technical and literacy-based barriers. These efforts make farmers confident in the use of digital technologies and induce broader usage.

### Infrastructure Development

Enhancement of rural digital infrastructure is critical in addressing connectivity issues. Broadband and mobile network extension guarantees uninterruptable access to digital platforms even in areas far from urban centers. Subsidizing devices that are solar-powered or battery-supported can facilitate farmers' use of digital technologies, including in areas with an unreliable electricity grid. Enhanced infrastructure raises both accessibility and reliability levels, providing the foundation for effective digital take-up among rural farming communities.

### Policy Support and Incentives

Support from government and institutions can speed up digital adoption. Farm income support schemes enable farmers to afford smartphones, tablets, or sensors. Public-private partnerships can improve technology delivery through training, extension services, and access to platforms. Further, integrating e-agriculture services into current extension systems guarantees that farmers are advised through known and trusted local networks, blending new digital tools with known advisory systems.

### Community-Based Approaches

Building on collective action can transcend individual limitations. Farmers' groups and cooperatives are able to share resources, share equipment, and exchange technical support. Peer-to-peer learning through digital mentors or local champions promotes learning exchange, reinforces skills, and supports community-driven adoption. These methods not only expand access but also establish sustainable systems for ongoing digital use.

## Case Studies

### eKutir Krishi in India

The eKutir Krishi platform is a mobile service advisory that offers farmers timely advice on crop management, weather conditions, pests management, and input optimization. It helps farmers make informed decisions and allows them to remotely access expert advice. The platform has been successfully adopted in urban and semi-urban areas, where there is greater internet connectivity and higher digital literacy levels. Yet, adoption in distant rural pockets is still low due to issues like network coverage, lack of digital literacy, and inadequate training. Quite contrary to expectations, eKutir Krishi showcases the potential of advisories delivered through mobile-based solutions to increase productivity in the presence of proper infrastructure and education initiatives.

### Daksh Mobile Application

The Daksh mobile application, built as part of the Indian Council of Agricultural Research's (ICAR) Premiers Farmer Project, provides query-based, tailored advisory services to farmers. It enables users to ask precise questions regarding crop management, pest control, and irrigation and get back personalized answers from experts. Although the app offers a direct line of communication between farmers and experts, rural uptake is limited. Digital illiteracy, poor availability of smartphones, and poor infrastructure hinder full usage. Organized training schemes and local facilitation are needed to enhance the effectiveness and reach of Daksh in rural areas.

### Learning from Other Countries

Learning from other countries points to effective strategies for overcoming digital adoption limitations in rural agriculture. Farmer cooperatives and community organizations were key to spreading digital advisory services in Kenya and Nigeria. Cooperatives, through resource sharing, device sharing, and peer-to-peer advice, made significant contributions to rural adoption. Moreover, the introduction of digital tools into current extension services was found to work better than separate platforms, stressing the need to leverage technology with human intervention and local knowledge. These findings imply that whether digital agriculture tools work also relies not just on the technology but on the socio-economic and community environment wherein it is introduced.

## Future Prospects

- Soil Health-based AI Recommendations: Personalized advice on soil health, weather, and crop type.
- IoT Integration: Real-time monitoring of soil moisture, nutrients, and pest infestations through sensors.
- Gamification and Education Apps: Activating farmers to learn and adopt.
- Policy Alignment: Ongoing emphasis on digital inclusion, subsidies, and rural infrastructure development.

## Conclusion

The urban-rural digital divide constitutes a major setback to symmetrical uptake of E-Crop technologies. Its bridging will have to be done on a multi-pronged basis: enhancing infrastructure, increasing digital literacy, promoting access to finance, and boosting community-based interventions. Closing these gaps will enable agricultural actors to make digital agriculture part of sustainable productivity, economic empowerment, and rural development inclusivity.

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