Available online at
http://agrospheresmagazine.vitalbiotech.org/

ISSN (E): 2582 – 7022

Agrospheres:e- Newsletter, (2026) *7*(3), 59-63

Article ID: 928

Strengthening Farmer–Scientist Linkages through ICT

Soumyadeep Thakur[1*], Ashutosh Kumar[2], Anil Kumar[3], Manjul Jain[3]

[1]University Research Scholar, Department of Agricultural Extension, Bidhan Chandra Krishi Vishwavidyalaya, West Bengal - 741252

[2]SMS, Horticulture Vegetables KVK Narkatiyaganj, RPCAU Pusa

[3]Assistant Professor, Department of Agronomy, School of Agriculture, Eklavya University Damoh, Madhya Pradesh

*Corresponding Author
Soumyadeep Thakur*

Article History
Received: 10. 3.2026
Revised: 15. 3.2026
Accepted: 20. 3.2026

INTRODUCTION

Agriculture remains the backbone of rural livelihoods, particularly in developing countries like India. The success of agricultural innovation depends on the effective dissemination of knowledge from scientists to farmers and feedback from farmers to researchers. However, traditional extension systems often face limitations such as inadequate manpower, delayed information flow, and lack of localized solutions.

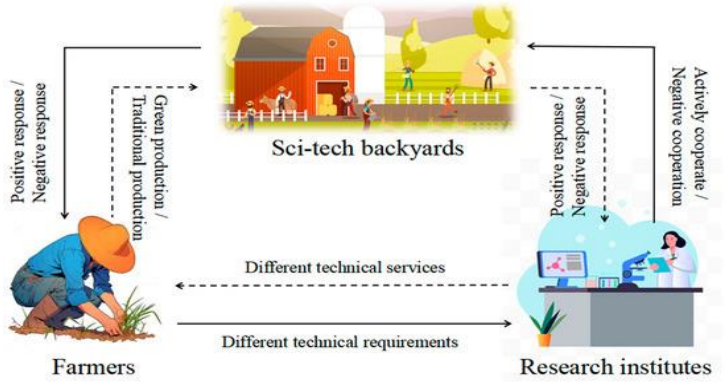
Information and Communication Technology (ICT) has revolutionized communication systems, offering new opportunities to strengthen farmer–scientist linkages. ICT enables two-way communication, timely advisory services, and access to a vast pool of agricultural knowledge. With the increasing penetration of smartphones, internet connectivity, and digital platforms, ICT has become a powerful tool in modern agricultural extension.

2. Concept of Farmer–Scientist Linkage

Farmer–scientist linkage refers to a dynamic and interactive relationship between farmers and agricultural researchers, aimed at improving agricultural productivity and sustainability. This linkage ensures a two-way flow of information where scientists transfer innovative technologies, improved crop varieties, and scientific management practices to farmers, while farmers provide valuable feedback based on their field experiences. Such interaction helps in identifying real-time problems, including pest outbreaks, soil fertility issues, and climate-related stresses, enabling scientists to refine and adapt technologies accordingly.

This relationship is not limited to one-way extension but emphasizes collaboration, where both farmers and scientists work together in problem-solving and innovation. It enhances the adoption of improved technologies by ensuring that they are practical, cost-effective, and suitable for local conditions. Moreover, farmer–scientist linkage promotes the development of location-specific solutions, considering variations in soil type, climate, and resource availability.

ISSN (E): 2582 – 7022



Source: https://www.mdpi.com/

2.1 Importance of Linkages

Strong farmer–scientist linkages play a crucial role in modern agriculture. They promote participatory research, where farmers actively contribute to the research process, making innovations more relevant and acceptable. These linkages also lead to increased agricultural productivity and sustainability by facilitating the timely adoption of best practices. Furthermore, they help in reducing yield gaps by ensuring that scientific advancements effectively reach the farming community and are implemented under real field conditions.

3. Role of ICT in Agriculture

Information and Communication Technology (ICT) encompasses a wide range of tools and technologies used for communication, data processing, and information dissemination. In agriculture, ICT plays a transformative role in bridging information gaps between farmers and scientists. It enables timely delivery of weather forecasts, helping farmers make informed decisions regarding sowing, irrigation, and harvesting. ICT also provides real-time market information, allowing farmers to choose the best time and place to sell their produce, thereby improving their income.

Furthermore, ICT facilitates the dissemination of improved crop management practices, including nutrient management, pest control, and water-use efficiency. Digital advisory services, delivered through mobile phones and internet platforms, ensure that farmers receive expert guidance without physical constraints. In addition, ICT supports farmer training and capacity building through e-learning modules, video demonstrations, and virtual workshops, enhancing their technical knowledge and skills.

Source: https://www.mdpi.com/

4. ICT Tools for Strengthening Farmer–Scientist Linkages

4.1 Mobile Phones and SMS Services

Mobile phones are one of the most accessible ICT tools in rural areas. SMS-based advisory services provide real-time information on weather updates, pest and disease outbreaks, and crop recommendations. Initiatives such as the Kisan SMS Portal and mKisan services enable scientists and extension workers to directly communicate with farmers in local languages, ensuring timely and relevant information delivery.

4.2 Mobile Applications

Smartphone applications have revolutionized agricultural communication by offering interactive and user-friendly platforms. Applications like Plantix help farmers diagnose crop diseases through images, while the Kisan Suvidha app provides information on weather, market prices, and input dealers. These apps allow direct interaction with experts and offer personalized recommendations based on specific farm conditions.

4.3 Internet and Web Portals

Agricultural web portals, including those developed by ICAR and State Agricultural Universities, serve as comprehensive knowledge hubs. They provide access to research publications, best management practices, advisory services, and online training modules, enabling farmers to stay updated with the latest scientific advancements.

4.4 Social Media Platforms

Social media platforms such as WhatsApp, YouTube, and Facebook have emerged as powerful tools for knowledge sharing. They facilitate group discussions, live demonstrations, and experience sharing among farmers and scientists, promoting peer learning and rapid dissemination of innovations.

4.5 Call Centers and Helplines

Kisan Call Centers (KCC) provide a direct communication channel where farmers can consult agricultural experts to resolve their queries. This real-time interaction strengthens trust and ensures accurate problem-solving.

4.6 Remote Sensing and GIS

Advanced ICT tools like remote sensing and Geographic Information Systems (GIS) enable scientists to monitor crop health, soil moisture, and climatic conditions. These technologies support site-specific recommendations, improving resource use efficiency.

4.7 Artificial Intelligence (AI) and Machine Learning

AI and machine learning technologies enhance decision-making in agriculture by providing predictive analytics, smart recommendations, and automated decision support systems. These tools help in early detection of problems and improve overall farm management efficiency.

5. Models of ICT-Based Farmer–Scientist Interaction

The integration of ICT in agriculture has led to the development of innovative models that strengthen interaction between farmers and scientists. These models focus on enhancing communication, promoting knowledge exchange, and ensuring participatory decision-making in agricultural development.

5.1 E-Extension Model

The E-Extension model involves the digital dissemination of agricultural information using ICT tools such as mobile phones, internet platforms, and digital media. Through this model, farmers receive timely updates on improved technologies, weather forecasts, pest and disease management, and market trends. Online training programs, webinars, and virtual workshops are conducted by agricultural experts and scientists to build farmers' capacity. This model reduces the dependency on physical extension services and ensures wider outreach, especially in remote and underserved areas.

5.2 Participatory ICT Model

The Participatory ICT model emphasizes a two-way communication system where farmers are not just passive recipients of information but active contributors. Farmers share their field experiences, local knowledge, and challenges through digital platforms such as mobile apps, social media, and feedback systems. Scientists, in turn, analyze this information to refine technologies and develop more practical and location-specific solutions. This collaborative approach enhances the relevance, adaptability, and adoption of agricultural innovations.

5.3 Knowledge Sharing Platforms

Knowledge sharing platforms include digital forums, discussion boards, and online communities that connect farmers, scientists, extension workers, and other stakeholders. These platforms facilitate the exchange of ideas, success stories, and best practices. Farmer communities formed through ICT tools encourage peer-to-peer learning and collective problem-solving. Such platforms not only strengthen farmer–scientist linkages but also

foster innovation, transparency, and continuous learning within the agricultural sector.

6. Case Studies

6.1 e-Choupal Initiative

The e-Choupal initiative, launched by ITC, is one of the most successful ICT-based models for strengthening farmer–scientist and farmer–market linkages in India. It provides farmers with real-time access to market prices, weather forecasts, and improved agricultural practices through internet-enabled kiosks set up in rural areas. Farmers can make informed decisions regarding crop management and marketing, reducing their dependence on intermediaries. The platform also facilitates knowledge sharing between experts and farmers, thereby enhancing productivity and profitability.

6.2 Digital Green

Digital Green is an innovative approach that uses video-based learning to disseminate agricultural knowledge. It involves creating locally relevant videos featuring farmers and experts, which are then shared within communities. This method enhances understanding and trust, as farmers relate more easily to familiar faces and local conditions. It promotes community participation, encourages peer learning, and strengthens the connection between farmers and agricultural scientists.

6.3 Kisan Call Centers (KCC)

Kisan Call Centers provide toll-free advisory services to farmers across the country. Farmers can directly communicate with agricultural experts and scientists to seek solutions for their field-level problems. This system ensures quick, reliable, and personalized advice, thereby strengthening farmer–scientist interaction and improving decision-making at the farm level.

7. Benefits of ICT in Farmer–Scientist Linkages

ICT-based linkages offer numerous advantages in modern agriculture. One of the key benefits is the provision of timely information through real-time advisory services, which helps farmers respond effectively to changing conditions. ICT also improves accessibility, ensuring that even farmers in remote areas can access scientific knowledge and expert guidance. It is cost-effective, as it reduces the need for frequent physical visits by extension workers. Additionally, ICT empowers farmers by enhancing their decision-making abilities and increasing their confidence in adopting new technologies. Transparency in communication further builds trust and accountability between farmers and scientists.

8. Challenges in ICT Adoption

8.1 Digital Divide

A significant challenge in ICT adoption is the digital divide, where many rural areas still have limited internet access. Small and marginal farmers often lack access to smartphones and digital devices, restricting their participation in ICT-based services.

8.2 Literacy and Awareness

Low levels of digital literacy and lack of awareness hinder effective use of ICT tools. Language barriers further complicate access to information, especially when content is not available in local languages.

8.3 Infrastructure Issues

Inadequate infrastructure, including poor network connectivity and unreliable power supply, affects the consistent use of ICT services in rural areas.

8.4 Content Relevance

Another major issue is the lack of location-specific and need-based content. Generic recommendations may not be suitable for diverse agro-climatic conditions, reducing their effectiveness.

8.5 Institutional Barriers

Weak coordination between research institutions, extension agencies, and policymakers limits the efficient implementation of ICT initiatives. Strengthening institutional frameworks is essential for maximizing the potential of ICT in agriculture.

9. Strategies for Strengthening Linkages

Strengthening farmer–scientist linkages through ICT requires a comprehensive and inclusive approach. One of the key strategies is **capacity building**, which involves training farmers in the effective use of digital tools such as smartphones, mobile applications, and online platforms. Digital literacy programs are essential to ensure that farmers can access, interpret, and utilize the information provided through ICT systems.

Localization of content important strategy is the Agricultural information must be delivered in local languages and tailored to specific agro-climatic conditions. Context-specific recommendations enhance the relevance and usability of scientific knowledge, leading to better adoption at the farm level.

Public–private partnerships (PPP) play a crucial role in expanding ICT-based agricultural services. Collaboration among government

agencies, private companies, and non-governmental organizations helps in resource mobilization, innovation, and wider outreach. These partnerships can accelerate the development and dissemination of digital solutions for agriculture.

Infrastructure development is also vital for effective ICT implementation. Improving internet connectivity, mobile network coverage, and reliable power supply in rural areas ensures uninterrupted access to digital services. Without strong infrastructure, the benefits of ICT cannot reach the intended users.

Traditional extension methods finally, integrating ICT with enhances overall effectiveness. Combining digital tools with field visits, demonstrations, and farmer interactions ensures better understanding, trust, and adoption of technologies.

10. Future Prospects

The future of farmer–scientist linkages is closely tied to emerging digital technologies. Innovations such as Artificial Intelligence (AI) and Big Data will enable predictive analytics and data-driven decision-making in agriculture. The Internet of Things (IoT) will facilitate real-time monitoring of soil, crops, and weather conditions through smart sensors. Blockchain technology has the potential to improve transparency and traceability in agricultural supply chains, ensuring fair pricing and reducing exploitation. Additionally, drone technology will revolutionize crop monitoring, precision spraying, and resource management. Digital agriculture platforms will continue to evolve, creating more interactive and integrated systems that connect farmers, scientists, markets, and policymakers. These advancements will promote precision farming, climate-smart agriculture, and sustainable resource management, ultimately strengthening farmer livelihoods and ensuring global food security.

CONCLUSION

ICT has immense potential to strengthen farmer–scientist linkages by enabling efficient communication, knowledge sharing, and collaboration. While challenges exist, strategic interventions and policy support can enhance ICT adoption and effectiveness. Strengthening these linkages will lead to sustainable agricultural development, improved livelihoods, and enhanced food security.

REFERENCES

Alam, M. M., & Shaba, S. A. (2023). ICT-enabled agricultural extension: How to promote and sustain?. *Information Development*, *39*(3), 600-610.

Barakabitze, A. A., Fue, K. G., & Sanga, C. A. (2017). The use of participatory approaches in developing ICT-based systems for disseminating agricultural knowledge and information for farmers in developing countries: The case of Tanzania. *The Electronic Journal of Information Systems in Developing Countries*, *78*(1), 1-23.

Byerlee, D., & Tripp, R. (1988). Strengthening linkages in agricultural research through a farming systems perspective: the role of social scientists. *Experimental Agriculture*, *24*(2), 137-151.

Compton, J. L. (1984). Linking scientist and farmer: Rethinking extension's role.

Smith, O., Avila, M., & Abdi, N. (2004, May). Strengthening linkages between farmers' organizations and agricultural research institutions. In *Proceedings of 36th World Farmers Congress IFAP* (pp. 1-11).