

Community Based Agricultural Extension Models for Accelerating Technology Adoption among Small Farmers

Indra Jeet 

ICAR-RCER, Krishi Vigyan Kendra, Ramgarh, Jharkhand, India

Received 07 July 2018 | Revised 05 August 2018 | Accepted 10 September 2018 | Available Online 14 October 2018

*Corresponding Author: **Indra Jeet** | Email Address: indrakvk80@gmail.com

Citation: Indra Jeet (2018). Community Based Agricultural Extension Models for Accelerating Technology Adoption among Small Farmers. *Life Science Review*. DOI: <https://doi.org/10.51470/LSR.2018.02.02.01>

Abstract

Smallholder farmers constitute a major share of agricultural producers in developing regions, yet their access to timely agricultural information and improved technologies often remains limited due to constraints in conventional extension delivery systems. Community based agricultural extension models have emerged as effective mechanisms to bridge this gap by promoting participatory learning, farmer-to-farmer knowledge exchange, and locally driven technology dissemination. These models leverage community institutions, progressive farmers, and grassroots organizations to enhance trust, relevance, and accessibility of advisory services. This review analyzes the role of community-based extension approaches in accelerating technology adoption among small farmers, examines their impacts on productivity and livelihoods, and discusses operational challenges and future opportunities. Strengthening community-driven extension systems, supported by institutional collaboration and digital innovations, can significantly enhance technology uptake, agricultural sustainability, and income security among smallholder farming communities.

Keywords: *Community extension, farmer-to-farmer learning, smallholder farmers, technology adoption, participatory extension, rural development.*

1. Introduction

Agriculture remains a primary source of livelihood for a large proportion of rural households in many developing countries, where small and marginal farmers dominate the agricultural landscape. These farmers often operate under conditions characterized by limited landholdings, fluctuating climatic conditions, resource constraints, and restricted access to improved technologies and markets. Enhancing agricultural productivity and farm income therefore depends not only on technological innovations but also on effective systems that ensure timely transfer of knowledge and support services to farming communities. Agricultural extension services traditionally play a vital role in disseminating improved crop production practices, promoting adoption of modern technologies, and strengthening farmer capacities through training and field demonstrations. However, conventional extension systems often face operational challenges such as limited manpower, inadequate infrastructure, and difficulty in reaching remote or resource-poor areas. In many regions, the ratio of extension personnel to farmers remains extremely low, making it difficult to provide personalized advisory services and follow-up support [1]. As agricultural challenges become more complex due to climate variability, emerging pest and disease threats, and market fluctuations,

farmers require more localized and continuous support than traditional extension systems can often provide, community-based agricultural extension models have emerged as promising alternatives that strengthen local participation and enhance technology dissemination at the grassroots level. These models emphasize active involvement of farmers, community institutions, and local organizations in extension activities, thereby decentralizing knowledge transfer processes. Instead of relying solely on government extension workers, community-based approaches encourage progressive farmers, farmer groups, and trained local facilitators to serve as knowledge intermediaries within their communities. Peer-to-peer learning and participatory extension approaches have proven particularly effective because farmers tend to trust and adopt technologies demonstrated successfully by fellow farmers operating under similar agroecological and socio-economic conditions [2]. Community-led extension initiatives also enable adaptation of technologies to local needs and resource availability, ensuring higher relevance and sustainability of innovations. Such approaches build local ownership and promote continuous learning among farming communities. In recent years, the importance of community-based extension systems has further increased as governments and

© 2018 by the authors. This is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

development organizations seek cost-effective and scalable methods to support large numbers of smallholder farmers. Farmer producer organizations, self-help groups, cooperative societies, and village-level institutions increasingly play central roles in organizing training programs, facilitating access to inputs, and improving collective marketing opportunities. These institutions strengthen farmers' bargaining power and create platforms for collaborative problem solving.

Moreover, growing digital connectivity in rural areas has opened opportunities to integrate digital advisory services with community-based extension efforts [3]. Community resource persons can help farmers interpret digital advisories and apply recommendations in local contexts, thereby bridging digital literacy gaps. Such hybrid extension systems combining community participation and digital innovations have the potential to accelerate agricultural transformation, the growing recognition of community-based extension models, challenges related to institutional support, sustainability, and inclusive participation still need to be addressed to maximize their effectiveness. Understanding the strengths, limitations, and future opportunities of these approaches is therefore essential for designing policies and programs that enhance technology adoption and improve rural livelihoods. This review article examines different community-based agricultural extension models and their role in accelerating technology adoption among small farmers. It also discusses impacts on farm productivity and livelihoods, identifies key implementation challenges, and highlights future strategies for strengthening community-driven extension systems to support sustainable agricultural development.

Table 1. Major Community Based Agricultural Extension Models and Their Role in Technology Adoption

Extension Model	Key Characteristics	Role in Technology Adoption	Impact on Farmers
Farmer Field Schools	Group-based seasonal learning through field experiments	Builds practical understanding and confidence in new technologies	Improved crop management and higher productivity
Farmer to Farmer Extension	Knowledge sharing by trained progressive farmers	Faster technology diffusion through peer trust	Increased adoption among neighboring farmers
Farmer Producer Organizations	Collective institutions supporting production and marketing	Facilitates access to improved inputs and technologies	Better income through collective marketing and input purchase
Women Self Help Groups	Community women groups involved in agriculture and allied activities	Promotes household-level adoption of improved practices	Improved nutrition and supplementary income
Village Adoption and Demonstration Programs	Community-wide technology demonstrations	Encourages community-level adoption of innovations	Increased productivity at village scale
Community Resource Persons	Locally trained facilitators providing advisory support	Provides continuous localized guidance	Improved problem-solving and technology implementation
Youth and Community Based Agri Groups	Youth-led agricultural enterprises and service delivery	Promotes adoption of modern practices and services	Generates rural employment and entrepreneurship opportunities

2. Concept and Importance of Community Based Extension

Community-based agricultural extension refers to extension approaches in which local communities actively participate in the dissemination and adaptation of agricultural technologies rather than depending solely on external experts. These models recognize farmers not just as beneficiaries but as partners in knowledge creation, experimentation, and technology transfer. By strengthening local capacity and encouraging collective learning, extension activities become more responsive to local farming conditions and socio-economic realities. In many rural areas, farmers often rely on informal networks such as neighbors, relatives, and experienced farmers when making farming decisions [4]. Community-based extension formalizes and strengthens these networks by training local farmers or community members to act as facilitators or knowledge providers. Such local facilitators understand local cropping patterns, resource constraints, and climate conditions, making advisory services more relevant and practical. An important strength of community-based extension systems lies in trust and social acceptance. Farmers are more inclined to adopt new practices when they observe successful outcomes on nearby farms. Demonstrations conducted within the community help reduce perceived risks associated with adopting new technologies.

Additionally, peer discussions allow farmers to exchange experiences and refine technologies according to local needs [5]. Community participation also reduces dependency on government extension staff, making extension delivery more sustainable and cost-effective. In many developing regions where extension manpower is insufficient, community-based approaches help bridge the outreach gap. Local involvement ensures continuity of advisory services even when external support is limited, these models encourage collective action among farmers in areas such as input procurement, water management, machinery sharing, and marketing. Cooperation among farmers strengthens resilience and enables better management of common resources. Community-based extension thus plays a critical role in enhancing productivity while simultaneously strengthening social and institutional networks within rural communities.

3. Major Community Based Extension Approaches

Several community-driven extension models have been successfully implemented across agricultural regions, each aiming to enhance farmer participation and knowledge dissemination. Farmer Field Schools are among the most widely recognized participatory extension approaches. In this model, groups of farmers meet regularly throughout a cropping season to observe crop growth, identify field problems, and experiment with improved practices.

Farmers learn through observation and collective decision-making, which improves understanding and encourages independent problem-solving skills.

Farmer-to-farmer extension represents another effective approach in which trained farmers share knowledge with fellow farmers through demonstrations and informal interactions. Since farmers trust peers who face similar challenges, technologies demonstrated by local farmers are often adopted more rapidly [11]. This approach also allows extension information to spread quickly across communities without requiring large numbers of extension workers. Farmer Producer Organizations and cooperative societies increasingly serve as platforms for extension activities. These institutions organize training sessions, facilitate input supply, and coordinate marketing activities. Through collective action, farmers gain better access to technologies, markets, and financial services, strengthening both productivity and income opportunities [6]. Women self-help groups and youth-based agricultural groups also contribute to extension delivery, particularly in areas such as vegetable cultivation, poultry farming, seed production, and food processing. These groups promote skill development and entrepreneurship while supporting technology dissemination within communities. Participation of women enhances household-level adoption of improved practices and contributes to nutrition and income security.

Village adoption programs and cluster demonstrations conducted by extension agencies allow entire communities to adopt improved technologies simultaneously. Demonstrations conducted under real farming conditions allow farmers to evaluate performance before adopting innovations. Such approaches accelerate technology diffusion within villages. In recent years, digital tools have begun complementing community extension approaches [10]. Mobile-based advisory services, digital training videos, and social media platforms allow communities to access expert knowledge while local facilitators help interpret and apply recommendations. Integration of digital tools with community networks enhances extension efficiency and reach.

4. Role in Accelerating Technology Adoption

Community-based extension systems significantly accelerate technology adoption by reducing information barriers and increasing farmer confidence in new practices. When technologies are demonstrated locally and farmers observe tangible benefits under familiar conditions, they are more willing to adopt innovations. Peer influence plays a strong role in adoption decisions, especially among small farmers who tend to be risk-averse. Participatory learning methods encourage farmers to test technologies on their own fields, allowing them to adapt recommendations according to local soil, climate, and resource conditions. Such adaptation improves technology suitability and long-term adoption. Continuous interaction among farmer groups promotes exchange of ideas and collective problem solving, ensuring

that farmers receive ongoing support. Local facilitators provide timely guidance during crop seasons, helping farmers manage pest outbreaks, nutrient deficiencies, and weather-related challenges [7]. Regular follow-up and advisory support reduce technology failure risks and improve farmer satisfaction. Collective adoption of technologies such as improved seed varieties, integrated pest management, and resource conservation practices further accelerates diffusion across communities. Group-based extension also supports adoption of farm mechanization services, irrigation systems, and post-harvest management technologies. Farmers who cannot individually afford machinery can collectively access custom hiring services or shared equipment. Such cooperation reduces financial barriers to adoption.

Community networks also facilitate rapid information dissemination during emergencies such as pest outbreaks or extreme weather events. Quick sharing of solutions helps minimize losses and supports resilience among farming communities.

5. Impact on Small Farmer Productivity and Livelihoods

Community-based extension approaches often result in measurable improvements in farm productivity due to better adoption of recommended practices. Improved crop management techniques, efficient input use, and timely pest control measures lead to higher yields and reduced production risks. Farmers gain confidence in applying modern practices when they witness successful results within their communities. Income improvement occurs not only through yield increases but also through diversification of farming activities. Extension programs encourage farmers to integrate horticulture, livestock, fisheries, and agroforestry into farming systems. Diversified income sources reduce vulnerability to crop failures and stabilize household earnings. Community extension initiatives also strengthen collective marketing and reduce transaction costs. Farmer groups and producer organizations facilitate bulk selling of produce, enabling farmers to obtain better prices. Collective procurement of inputs further reduces production expenses, improving profitability. Participation in community extension activities enhances farmers' knowledge, leadership skills, and decision-making capacity. Social cohesion and collaboration among community members improve management of shared resources such as irrigation systems and common lands. Women participating in extension activities often contribute to household nutrition improvement through kitchen gardens and small livestock enterprises [8]. Youth involvement in community extension programs creates opportunities for rural entrepreneurship in areas such as agri-services, mechanization, and value addition. These activities generate employment opportunities within rural areas, reducing migration pressures, community-based extension strengthens both agricultural productivity and rural livelihoods by promoting collaborative learning, technology adoption, and income diversification.

Continued support and strengthening of these models can contribute significantly to sustainable agricultural development and poverty reduction in rural regions.

6. Challenges in Community Based Extension Models

Despite their benefits, community-based extension models face several challenges. Sustainability of volunteer facilitators may be uncertain if adequate incentives or support mechanisms are not provided. Some communities may face difficulties in organizing effective farmer groups due to social or economic disparities. Limited technical support and inadequate training of community resource persons can reduce effectiveness. Institutional coordination between extension agencies and community groups may sometimes be weak, leading to duplication of efforts or inconsistent advisory services [9]. Financial constraints and limited access to infrastructure also hinder scaling up of community extension initiatives. Ensuring participation of marginalized groups and women remains a challenge in some regions.

7. Future Prospects and Opportunities

Future community-based extension systems can benefit significantly from integration with digital technologies. Mobile advisory services, digital training materials, and online farmer networks can complement local extension efforts. Community facilitators can act as intermediaries between digital platforms and farmers lacking digital literacy. Strengthening farmer producer organizations, promoting youth participation, and supporting women-led extension initiatives can further improve outreach. Public-private partnerships can provide financial and technical support to expand successful models.

Policy support focusing on decentralized extension delivery, capacity building, and community empowerment will be crucial for long-term sustainability.

8. Conclusion

Community based agricultural extension models have emerged as effective and inclusive approaches for accelerating technology adoption among smallholder farmers by strengthening local participation and peer learning mechanisms. These models reduce dependence on limited formal extension systems and promote farmer-to-farmer knowledge exchange, ensuring that technologies are tested and adapted under local conditions before wider adoption. Increased involvement of farmer groups, producer organizations, women self-help groups, and rural youth further strengthens technology dissemination and enhances livelihood opportunities within communities. The success of community-driven extension systems lies in building trust, encouraging collective action, and providing continuous support to farmers in managing production challenges. When combined with digital advisory tools and institutional support, these approaches can significantly enhance productivity, resource-use efficiency, and income

diversification among small farmers. However, sustaining such models requires continuous capacity building, financial and policy support, and inclusive participation of marginalized groups. Future agricultural development strategies should focus on integrating community-based extension with modern digital innovations to create resilient and responsive knowledge systems. Strengthening grassroots extension networks will be essential for ensuring sustainable agricultural growth, improved rural incomes, and long-term livelihood security for smallholder farming communities.

References

1. Feder, G., Anderson, J. R., Birner, R., & Deininger, K. (2010). Promises and realities of community-based agricultural extension. In *Community, market and state in development* (pp. 187-208). London: Palgrave Macmillan UK.
2. Suvedi, M., Ghimire, R., & Kaplowitz, M. (2017). Farmers' participation in extension programs and technology adoption in rural Nepal: a logistic regression analysis. *The Journal of Agricultural Education and Extension*, 23(4), 351-371.
3. Aker, J. C. (2011). Dial "A" for agriculture: a review of information and communication technologies for agricultural extension in developing countries. *Agricultural economics*, 42(6), 631-647.
4. Abebaw, D., & Haile, M. G. (2013). The impact of cooperatives on agricultural technology adoption: Empirical evidence from Ethiopia. *Food policy*, 38, 82-91.
5. Ogada, M. J., Mwabu, G., & Muchai, D. (2014). Farm technology adoption in Kenya: a simultaneous estimation of inorganic fertilizer and improved maize variety adoption decisions. *Agricultural and food economics*, 2(1), 12.
6. Shiferaw, B. A., Kebede, T. A., & You, L. (2008). Technology adoption under seed access constraints and the economic impacts of improved pigeonpea varieties in Tanzania. *Agricultural Economics*, 39(3), 309-323.
7. Meijer, S. S., Catacutan, D., Ajayi, O. C., Sileshi, G. W., & Nieuwenhuis, M. (2015). The role of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. *International journal of agricultural sustainability*, 13(1), 40-54.
8. Mwangi, M., & Kariuki, S. (2015). Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of Economics and sustainable development*, 6(5).
9. Gandhi, R., Veeraghavan, R., Toyama, K., & Ramprasad, V. (2007, December). Digital green: Participatory video for agricultural extension. In *2007 International conference on information and communication technologies and development* (pp. 1-10). IEEE.
10. Sunding, D., & Zilberman, D. (2001). The agricultural innovation process: research and technology adoption in a changing agricultural sector. *Handbook of agricultural economics*, 1, 207-261.
11. Mulwa, C., Marenya, P., & Kassie, M. (2017). Response to climate risks among smallholder farmers in Malawi: A multivariate probit assessment of the role of information, household demographics, and farm characteristics. *Climate risk management*, 16, 208-221.