Changing Role of Agricultural Extension in India: From Technology Transfer to Digital, Market-Linked and Networked Advisory Systems

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ABSTRACT

Agricultural extension in India is passing through a significant transition. For decades, extension was largely understood as a public mechanism for transferring technologies, improved practices, and research-based recommendations from laboratories and universities to farmers. That role remains foundational, but the environment in which farmers now take decisions has become far more complex. Agriculture is increasingly shaped by climate variability, market volatility, changing pest dynamics, rising input costs, diversification into high-value crops, quality and traceability requirements, and rapid growth of digital communication channels. At the same time, farmers no longer depend only on formal extension institutions for information. They now receive advice from mobile applications, social media platforms, agri-startups, FPOs, local influencers, input networks, and peer communities. Recent policy developments reflect this shift. Bharat-VISTAAR, launched in Phase I on 17 February 2026, has been positioned by the Government of India as an AI-based multilingual farmer advisory platform accessible through multiple channels, including phone, chatbot, web portal, and app, and integrating information on schemes, weather, market prices, crop advisory, and grievance support. Public extension systems are therefore being called upon to move beyond one-way dissemination of technology and become systems of decision support, risk communication, knowledge validation, and market readiness. This article argues that the future of agricultural extension lies in combining the credibility of field-based public institutions with the scale of digital systems, the immediacy of social media, and the participatory energy of peer-led agricultural communication. It also highlights the continuing importance of ATMA, BTM, and ATM structures, the urgent need for capacity building of extension workers, and the emerging challenge of fake, unverified, commercially motivated, and misleading digital media content in agriculture.

Keywords: Agricultural Extension, Digital Advisory, Bharat-VISTAAR, ATMA, Social Media, Agri-Influencers

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1. Introduction

Agricultural extension has historically been one of the most important institutional pillars of India's agricultural development process. Its central purpose has been to connect scientific research, policy support, and field-level practice. Through demonstrations, field visits, training programmes, farmer meetings, and advisory services, extension has helped translate technical recommendations into practical decisions in farmers' fields. Public institutions such as state agriculture departments, Krishi Vigyan Kendras, agricultural universities, and district and block-level extension structures have collectively contributed to technology diffusion, productivity improvement, and strengthening of farmer awareness. ICAR's Agricultural Extension Division continues to define its work in terms of technology application, frontline extension education, knowledge management, and capacity development of both farmers and extension personnel (ICAR, 2026).

However, the agricultural extension has to redefine its role significantly as the world in which it operates has undergone profound changes. The older agricultural policy environment was dominated by the challenge of low productivity and the need to expand adoption of scientific methods. Today, farmers operate in a far more uncertain and dynamic setting. Decisions on crop choice, sowing time, irrigation, pest control, harvest, and sale are influenced not only by technical recommendations but also by rainfall variability, extreme weather, labour availability, price fluctuations, quality standards, storage infrastructure, digital access, and the design of government schemes. As a result, extension has to serve not only as an instrument of technology dissemination but also as a support system for risk management, bank access, market linkage, farmers empowerment, income enhancement, and strategic decision-making (ICAR, 2026).

The communication landscape has changed as dramatically as the production landscape. Farmers today often receive agricultural information through WhatsApp groups, YouTube channels, Facebook pages, Telegram communities, voice messages, mobile apps, local entrepreneurs, FPO leaders, and progressive farmers who have emerged as digital communicators. Social media is no longer peripheral to agricultural learning; in many regions it has become a major parallel pathway of information exchange. MANAGE publications have recognized the growing relevance of social media for agricultural communication, networking, collaboration, and dissemination. This means that extension is no longer the sole source of information. It is one actor in a much broader knowledge ecosystem (MANAGE, 2017).

In this changing context, the role of extension is being redefined. It is moving

from a narrow "transfer of technology" approach toward a broader model of "facilitation of decisions." It is moving from a largely production-oriented logic toward a farm-to-market and value-chain orientation. It is also moving from periodic physical contact to a blended ecosystem of human interface, digital platforms, social media communication, and networked peer learning. This transition is not merely technological. It is conceptual, institutional, and strategic (PIB, 2026).

2. Objectives

This article seeks to examine the changing role of agricultural extension in India in the light of current agricultural, institutional, and communication realities. It aims to explain why extension continues to remain vital, even as its methods, scope, and competencies are changing. It also seeks to highlight the continuing relevance of decentralized extension structures such as ATMA and the role of block-level functionaries like BTMs and ATMs. In addition, it analyses the implications of digital advisory systems, Bharat-VISTAAR, social media-based communication, the rise of agri-influencers, and the spread of fake or misleading agricultural content. Finally, it argues that capacity building of extension workers has become central to the success of future agricultural transformation (PIB, 2026b).

3. Methodology

This is a conceptual and analytical paper based on review of policy material, institutional publications, official releases, and knowledge resources related to agricultural extension, digital advisory systems, social media, and extension capacity building. Official government releases on Bharat-VISTAAR, ICAR material on extension achievements and mandates, and MANAGE publications on ATMA, social media, and extension education form the principal factual base of the discussion. The article is interpretive in nature and is intended to contribute to policy and institutional thinking on agricultural extension rather than to present field-survey findings (PIB, 2026b).

4. Importance of Extension Services in Agriculture

Agricultural extension remains indispensable because it is the bridge that converts knowledge into action. Research institutions may develop improved seeds, nutrient recommendations, pest-management protocols, water-saving methods, climate-resilient practices, post-harvest technologies, and digital tools, but these do not automatically improve farm outcomes unless they are understood, adapted, trusted, and applied by farmers. That last-mile process is the work of extension. Extension thus performs an enabling function that is simultaneously technical, educational, and institutional. It interprets scientific

knowledge for local conditions, demonstrates practical application, builds confidence among farmers, and connects farming households with the wider agricultural support system. ICAR's extension system explicitly includes technology assessment, frontline demonstrations, knowledge dissemination, and capacity building in its mandate, underlining that extension is not an auxiliary function but a core development function (ICAR, 2026).

The importance of extension has, if anything, increased in the current era. Farming has become more information intensive. Farmers need not only crop advice, but also weather-based alerts, market intelligence, information on procurement and schemes, guidance on risk reduction, support in crop diversification, and help in improving quality and value addition. Smallholders, in particular, need advisory support that is timely, understandable, and trustworthy. In an environment where wrong decisions can quickly translate into financial loss, extension serves as a form of public risk management. It reduces uncertainty by helping farmers choose more appropriate practices and by linking them to institutional support (PIB, 2026b).

Extension also matters because agriculture is not only about production. It is about income, resilience, and sustainability. Farmers increasingly require support in integrated farming, efficient use of water, better post-harvest management, market timing, collective action through FPOs, and adoption of environmentally sound practices. Without a strong extension system, many of these transitions remain confined to pilot projects or isolated success stories. Extension gives scale to innovation. It translates policy ambition into field-level adoption (ICAR, 2026b).

5. ATMA, BTM and ATM: Institutional Relevance in a Changing Era

The Agricultural Technology Management Agency, or ATMA, was conceived as a district-level mechanism to decentralize agricultural extension, integrate research and extension, and make local planning more responsive to farmer needs. MANAGE's ATMA material describes it as a new organizational arrangement intended to decentralize day-to-day management of the public agricultural technology system to the district level. This was a major institutional shift because it recognized that agricultural conditions differ across districts and blocks and that extension must be locally planned rather than uniformly transmitted from above (MANAGE, 1999).

ATMA's significance lies in its architecture of decentralization and convergence. It was designed to bring together extension and research actors, support farmer participation, and enable preparation of more location-specific strategic and annual extension plans. In principle, this model addressed one of the

long-standing weaknesses of extension administration: the tendency toward fragmented, department-wise functioning and insufficient field responsiveness. Even in a changing digital era, this institutional logic remains highly relevant. The need for local planning, convergence among agriculture and allied sectors, and farmer-responsive implementation has not declined. On the contrary, it has become more important as farming systems diversify (MANAGE, 1999).

At the block level, the roles of the Block Technology Manager and Assistant Technology Managers are central. MANAGE study material identifies BTMs and ATMs as important block-level extension functionaries who support farmer groups, Farm Schools, Farmer Friends, and field-level extension activity. They form the practical interface between district-level planning and village-level outreach. In operational terms, they mobilize farmers, coordinate demonstrations, facilitate trainings, support group processes, collect feedback, and help localize extension interventions. They are, in effect, the human face of decentralized extension (MANAGE, 2021).

In the current context, the value of these functionaries becomes even greater. Digital platforms can improve scale, but they cannot entirely replace contextual understanding. Farmers often need interpretation, reassurance, verification, and local adaptation of advice. BTMs and ATMs can play a crucial bridging role by translating digital advisories into local action and by feeding local realities back into the wider system. If revitalized and properly trained, they can become the backbone of blended extension, where digital services and field-level support reinforce one another rather than operate separately. MANAGE's continuing focus on BTMs and ATMs in its capacity-building programmes through partner organisations indicates that these roles remain institutionally important (MANAGE, 2021).

6. From Technology Transfer to Decision Support

The traditional description of extension as "transfer of technology" captured an important historical phase of Indian agriculture. At that stage, the central problem was often a gap between available scientific knowledge and actual farmer practice. Demonstrations, training, and structured advisories were therefore appropriate instruments. However, the idea of technology transfer assumes that there is a relatively stable package of recommendations that can be passed from expert to user. Contemporary agriculture is less stable than that. Decisions must be adjusted continuously according to rainfall patterns, heat conditions, market opportunities, pest emergence, logistics, and household economics (ICAR, 2026b).

This is why extension must increasingly be understood as a system of decision

support. The farmer of today does not only ask, "What is the recommended seed or dose?" The farmer also asks, "Should I sow now or wait? Should I shift to another crop? Should I sell immediately or store? Is this pest alert genuine? Which scheme am I eligible for? Is this video advice reliable?" These are practical decision questions under uncertainty. Extension, therefore, must support judgment as much as adoption (PIB, 2026b).

This broader role requires extension personnel to move beyond routine transmission of messages. They must understand local context, recognize farmer heterogeneity, and connect recommendations with market, climate, and institutional realities. It also requires that extension systems become more responsive and interactive, using feedback loops rather than only one-way communication. The changing role of extension, then, is not that it is becoming less important. It is that its importance now lies in a more complex function (ICAR, 2026b).

7. Climate Variability, Diversification and Market Orientation

One of the strongest drivers of change in agricultural extension is climate variability. Uncertain rainfall, heat stress, shifting pest incidence, water scarcity, and localized weather shocks have made agriculture far more risk-prone. Farmers need advisory support that is location-specific, timely, and adaptive. Generic seasonal recommendations are often insufficient in such a context. Extension must therefore engage more deeply with contingency planning, climate-smart practices, efficient resource use, and rapid communication (PIB, 2026).

Another major driver is diversification. Agriculture is no longer dominated only by a narrow set of staple crops. Horticulture, pulses, oilseeds, natural farming systems, integrated farming, and value-added enterprises are expanding in importance. This means extension needs to become more segmented and specialized. A one-size-fits-all approach is poorly suited to a sector in which farmers may require advice on post-harvest grading, protected cultivation, beekeeping, seed production, drip irrigation, branding, or collective marketing (ICAR, 2026b).

Market orientation has similarly changed the scope of extension. Farmers need not only production guidance but also assistance in price realization, aggregation, storage, processing, and market linkage. Social-media-enabled selling, digital price information, FPO channels, and quality-sensitive supply chains are making market literacy a necessary part of extension. In this sense, extension is moving from a "lab-to-land" model toward a "farm-to-market" or even "farm-to-value-chain" model. This is particularly important where income enhancement, not merely yield increase, is the policy objective (PIB, 2026c).

8. Bharat-VISTAAR and the Architecture of Next-Generation Extension

A major marker of this transition is Bharat-VISTAAR. Official government releases describe Bharat-VISTAAR as an AI-based, multilingual, integrated system intended to provide farmers with access to information related to crop advisory, government schemes, weather, market prices, and grievance support. It was launched in Phase I on 17 February 2026 and made available through multiple access channels, including a dedicated phone line, voice-based AI chatbot, web portal, and mobile application. The rollout note states that Phase I integrates ten major central schemes and is intended to expand to more languages over time (PIB, 2026b).

The significance of Bharat-VISTAAR lies not only in its technological features but also in what it says about the future of extension. First, it points toward integrated service delivery. Instead of farmers navigating multiple disconnected sources for scheme eligibility, market prices, crop advice, and complaint resolution, the platform seeks to bring these into a common interface. Second, it expands accessibility by including voice-based channels, which can matter greatly in a context where smartphone penetration, literacy, and language comfort vary widely. Third, it indicates that extension is becoming more conversational and potentially more personalized (PIB, 2026b).

Bharat-VISTAAR should not be understood as a substitute for extension personnel. Rather, it can be seen as an enabling layer that expands the reach, continuity, and responsiveness of public advisory. Its success will depend substantially on whether digital advice is linked with field verification, local institutions, and follow-up support. In other words, the best future is not "digital instead of human extension," but "digital plus human extension" PIB (2026c).

9. Social Media, Agri-Influencers and the New Communication Ecology

Social media has become one of the most powerful new spaces for agricultural communication. MANAGE publications and related literature have discussed the role of social media in communication, collaboration, online engagement, agricultural awareness, and youth involvement. Today, many farmers learn through short videos, peer demonstrations, influencer commentary, local-language posts, and informal digital communities. The attraction is obvious: social media is immediate, visual, repeatable, and often easier to understand than conventional technical literature (MANAGE, 2017).

This has changed the communication ecology of extension. Earlier, public institutions held a near-monopoly over formal agricultural advice. Now, progressive farmers, agri-startups, content creators, FPO leaders, development organisations, input companies, agribusiness firms and machinery suppliers

often shape perceptions and behaviour. These agri-influencers can perform a positive role by translating technical messages into relatable language, showing actual field practice, and creating peer confidence around adoption. They can make extension more participatory and conversational (Suchiradipta and Raj, 2018).

At the same time, this environment requires public institutions to rethink their communication strategies. It is no longer enough to issue circulars, organize meetings, or publish manuals. Credible extension must now also be visible, timely, and understandable in the media ecosystems where farmers actually spend their attention. MANAGE's work on mobile journalism for extension professionals is relevant in this regard because it reflects the growing need for extension institutions to communicate better in digital formats (MANAGE, 2024).

10. Challenge of Fake, Unverified, Motivated and Misleading Digital Media Posts

The rise of digital communication has created immense opportunities, but it has also generated a serious threat: the spread of fake, unverified, motivated, and misleading agricultural information. Multiple recent sources discussing social media in agricultural contexts identify misinformation, digital literacy gaps, and unreliable content as important constraints. Research and practice discussions note that misinformation can spread rapidly on social media, creating confusion, mistrust, and poor decision-making in farming communities (Kaviya & Natarajan, 2025).

In agriculture, the harm can be immediate and material. False claims may be made about pesticides, miracle inputs, pest-control remedies, crop cures, procurement arrangements, prices, subsidy eligibility, or government actions. Some content is commercially motivated, some is carelessly shared, and some may be deliberately misleading. Farmers are especially vulnerable when such information is presented in vernacular language, delivered through emotionally persuasive videos, or repeatedly circulated within trusted peer groups. In such settings, misinformation can travel faster than scientific correction (Shelke and Murai Atul, 2024).

This challenge changes the role of extension in a fundamental way. Extension agencies can no longer remain only transmitters of information. They must increasingly become validators of information quality. They need to identify falsehoods, issue clarifications quickly, produce simple myth-busting content, and establish themselves as trusted public fact-checkers in agriculture. The credibility of extension in the future will depend not only on whether it can

provide advice, but also on whether it can defend farmers against bad advice (MANAGE, 2024).

In practical terms, this means extension systems must maintain an active digital presence. Silence in digital spaces creates room for misinformation. Timely, short, local-language, farmer-friendly content can serve as a preventive as well as corrective tool. Extension workers also need to teach farmers a basic culture of verification: check the source, confirm with local officials or KVK experts, and avoid acting on sensational or commercially charged claims without validation (MANAGE, 2024).

11. Need for Capacity Building of Extension Workers

If the role of extension is changing so deeply, then the role of the extension worker is changing equally deeply. Capacity building is therefore not a side issue. It is central. ICAR reports that the knowledge and skills of about 1.16 lakh extension personnel were upgraded through 3,948 training programmes, which itself reflects recognition of the scale of the challenge. Capacity development is explicitly part of the extension mandate (ICAR, 2026b).

The modern extension worker must know far more than conventional agronomy. He or she must understand climate-smart agriculture, integrated farming, market-linked extension, digital service platforms, AI-enabled advisory, FPO dynamics, natural farming, post-harvest handling, and behaviour change communication. In addition, because of the rise of social media and misinformation, extension workers need skills in digital communication, content curation, source verification, and quick response messaging. MANAGE and related publications on social media and mobile journalism suggest precisely this broadening of communication expectations from extension professionals (MANAGE, 2024).

This capacity-building requirement is particularly important for ATMA, BTM, ATM, KVK, and state department personnel, because they are the last-mile interface with farmers. If they are not regularly updated, they can neither command farmer trust nor interpret new systems effectively. A digital platform, however sophisticated, is weakened if the field functionary cannot explain or support it. Conversely, a well-trained field worker can greatly amplify the value of a digital system (ICAR, 2026b).

Capacity building must therefore be continuous, modular, and future-oriented. It should not be limited to occasional technical refreshers. It should include field realities, communication methods, market understanding, platform use, and misinformation response. Training also needs to become more practice-based, with real cases, digital demonstrations, and local problem-solving.

The extension worker of the future is not merely an instructor. He or she is a knowledge navigator, digital mediator, trust-builder, and local problem-solver (ICAR, 2026b).

12. Policy Implications

Several policy implications follow from this analysis. First, India needs a blended model of extension in which digital platforms expand scale and continuity, while human institutions provide trust, interpretation, and contextual adaptation. Second, decentralized extension systems such as ATMA should be revitalized and integrated more closely with digital public platforms so that local planning and national digital resources work together. Third, block-level functionaries like BTMs and ATMs need stronger professional support because they are central to field translation of advisory systems MANAGE (1999).

Fourth, public extension agencies should treat misinformation management as a core function, not a peripheral concern. This means building rapid-response mechanisms, myth-busting communication, and verified multilingual digital outreach. Fifth, extension capacity building must expand from technical training to include digital literacy, market intelligence, communication design, and information verification. Sixth, public institutions should engage with credible agri-influencers and farmer leaders rather than ignore them, while retaining scientific standards and accountability (MANAGE, 2024).

13. Extension as Behaviour Change and Social Mobilisation

A modern understanding of extension also requires recognition that farmers do not adopt innovations merely because information is available. Adoption depends on trust, affordability, perceived risk, peer examples, local norms, and visible results. Extension is therefore not only a process of information transfer but also a process of behaviour change and social mobilisation. Whether the subject is balanced fertilization, water-saving irrigation, natural farming, residue management, mechanization, crop diversification, or participation in FPOs, farmers often need repeated engagement before practice changes occur.

This makes communication strategy central to extension effectiveness. Demonstrations remain important because they reduce uncertainty. Farmer-to-farmer learning remains important because social proof matters. Timely advisory remains important because risk perception changes quickly in agriculture. Extension personnel must therefore be skilled in persuasion, listening, follow-up, and adaptation of messages to local realities. Behaviour change is especially relevant in areas where public policy seeks to encourage sustainable agriculture, efficient resource use, climate resilience, and group-based action.

14. Extension orientation of production departments

Production department has a crucial role to play in agriculture extension by taking care of various needs of the farmers ranging from enhanced production to linking the same with market. The responsibilities of the production department are no longer confined just to transfer of technology with focus on enhanced production. In the present environment, it is imperative to cover risk associated with the production, bank integration facilitating technology adoption, aggregation for achieving the scale, satisfaction of farmers and linking the surplus with market. Production department has to facilitate the process of farmers getting aggregated in groups through appropriate model for achieving the scale and improve access to common infrastructure and markets. Production planning is influenced by market demand and expected price and therefore, the production department needs to arrange timely availability of correct market information. There is also need for having a strong feedback mechanism ensuring two-way flow of information. The information on field level challenges faced by the farmers and their satisfaction with the existing technology suggested by the department will help in making extension more responsive and adaptive. As agriculture is undergoing changes and becoming comprehensive, there is need to follow holistic approach to help farmers enhance the income from agriculture. This expect the production department to focus beyond technology transfer to planning, processing, storage, transportation, risk mitigation and bank integration and marketing so as to make agriculture profitable for farmers.

15. Role of Women, Youth and Community Resource Persons

The changing role of extension must also be viewed through the lens of inclusion. Women play a major role in agricultural operations, livestock management, post-harvest work, seed care, and household-level decision-making, yet extension systems have often been insufficiently responsive to their needs and constraints. Similarly, rural youth are increasingly important as technology adopters, agri-entrepreneurs, custom hiring operators, digital communicators, and local service providers. Community resource persons, progressive farmers, and local para-extension workers can also become valuable carriers of agricultural knowledge.

Future-ready extension systems should therefore deliberately widen their social base. Women farmers need advisory that is accessible in terms of timing, language, and relevance. Youth can serve as digital bridges who help farmers access advisories, apps, market information, and platform-based services. Community resource persons can strengthen continuity where formal staffing is limited. In this sense, extension must evolve from a narrow departmental function into a broader ecosystem of public, community, and digital actors working together.

16. Toward a Future-Ready Extension Architecture

The changing role of agricultural extension in India ultimately points toward a new architecture rather than a single reform. This architecture would combine strong public credibility, decentralized field presence, AI-enabled digital access, verified social media communication, and sustained capacity building. It would preserve the strengths of face-to-face extension while adding speed, scale, and continuity through digital channels. It would also create better linkages among research institutions, extension departments, KVKs, FPOs, market systems, and grievance-redress mechanisms.

Such a system must remain farmer-centric. Technology is only useful when it improves decision quality at the farm level. Digital platforms are only meaningful when they are understandable and trusted. Social media outreach is only valuable when it is credible. Capacity building is only effective when it equips field workers to solve real problems. The long-term success of extension, therefore, will depend on whether India can design institutions that are both technologically advanced and locally grounded.

In the coming years, the most successful extension systems are likely to be those that combine four qualities: credibility, responsiveness, inclusiveness, and adaptability. Credibility will come from science-based public institutions. Responsiveness will come from data, local feedback, and real-time communication. Inclusiveness will come from better engagement with women, youth, community institutions, and diverse farming systems. Adaptability will come from continuous learning and capacity building within the extension machinery itself. These qualities together can redefine agricultural extension as a strategic public service for resilient and remunerative agriculture.

17. Conclusion

Agricultural extension in India is not becoming obsolete; it is being redefined. Its classical role of transferring technology remains important, but that alone is no longer enough for an agricultural system facing climate shocks, market volatility, diversified livelihoods, and digital information overload. The extension system must now help farmers not only adopt technologies, but also interpret information, manage uncertainty, access schemes, improve market readiness, and avoid misinformation (PIB, 2026b).

The continuing relevance of extension services is evident in the enduring importance of decentralized structures like ATMA and the frontline roles of BTMs and ATMs. At the same time, the emergence of Bharat-VISTAAR, social media-based learning, and peer communication networks shows that the modalities of extension are evolving rapidly. The future lies in synthesis:

public credibility with digital scale, field presence with AI-enabled access, and institutional authority with participatory communication (MANAGE, 1999).

One of the most important emerging lessons is that extension in the digital age must not only disseminate knowledge; it must also protect the quality of knowledge. Fake, unverified, and motivated digital media posts can harm farmers directly, and extension institutions must be prepared to counter them. This makes capacity building of extension workers even more urgent. A future-ready extension worker must be technically sound, digitally fluent, communicatively effective, and institutionally trusted. That is the real meaning of the changing role of agricultural extension in India today (Kaviya & Natarajan, 2025).

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