

# Temporal adaptation of agricultural extension systems in India

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*In developing countries, the major role of agricultural extensions is to disseminate farm technologies developed by the public funded research organizations, through demonstrations, field visits and farmers' meetings or through media and others. Earlier, the extension personnel were involved in technology diffusion, but in the last two decades, the nature of agricultural technology design and integration is drawing attention of the extension professionals and practitioners across the globe. In India, different models for transfer of farm technology have been tested and also robust extension education approaches have been validated. Furthermore, the frontline extension system of the country has been sharpened through more farmer-centric approaches for technology adaptation and dissemination. Globally too, the adjustment in public extension system is seen. Using China and USA as case studies, we highlight the changes the public extension system has undergone. The operational paradigm of the country's extension system has been suggested to move beyond technology and beyond commodity through ensured reciprocal farmer-research-extension linkages.*

**Keywords:** Adaptation, ATMA, extension delivery system, frontline extension system.

THE basic function of agriculture hitherto remains to ensure access to adequate and quality food, apropos the cross-section of people on time scale, giving them an active and healthy life. Food and nutritional security, on the other hand, is interwoven with numerous factors including increased production with sustained natural resources, protected and stable environment, and even international trade. The main reason for shifting the development paradigm since 1980s pivots to the enhanced concern for future generations to meet their basic needs. These concerns drew global attention, and are termed as sustainable development, which intends to bring out planned changes to meet the needs of the present generation without compromising the future generation's requirements<sup>1</sup>. Besides, sustainable agricultural practices also contemplate to reduce the use of external inputs like inorganic nutrients, plant protection chemicals besides the minimal tillage<sup>2</sup>.

With particular references to India and other developing countries, the Green Revolution was instrumental in augmenting total as well as per unit production of field crops, insuring food security and raising rural farm incomes. The country, however, still has a large population of poor and malnourished and the debate on poor contin-

ues even with consistently increasing price of commodity and its availability to common man. Enhancing the farm incomes may be considered as panacea for combating poverty. Though total food grain production has touched all time high magnitude of 260 million tonnes in 2011–12, agricultural growth rate in the eleventh plan (2007–12) has remained below 4.0% per year<sup>3</sup>. The 12th Five-Year Plan had also advocated for ensuring a minimum of 4% growth rate in agriculture during this plan period (2012–17). The agricultural regions receiving low and uncertain rainfall (arid and semiarid agro-eco situations) are to work for improving farm productivity and rural income. Farm producers located far-off and those unreached still suffer most from lack of access to appropriate services (credit, inputs, market, extension, etc).

Anticipating this context, the World Development Report<sup>4</sup> had focused on need to recognize agricultural extension as a pivot for realizing the growth potential of farm sector against the widening demand–supply pressures, and for ensuring sustainable, inclusive, and pro-poor agricultural and economic development. A call for agricultural extension services has been made at a time when the under utilization of the productivity and growth potential of the agricultural sector posed a serious challenges to food security and rural poverty.

## Evolution of agricultural extension delivery system

Farm technologies generated by public funded research organizations are mostly disseminated through appropriate

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mechanism, viz. demonstrations, field visits, farmers' meetings, media use, etc. and this remained the major role of agricultural extension in developing countries. This process had the conceptual backup from the 'diffusion of innovation' model<sup>5</sup>. Review of early works on diffusion of farm innovations revealed the mode of communication of new technologies to farmers and accordingly, the methods to speed up the diffusion process were suggested. The technology transfer approaches practiced in the past were often viewed as the linear model as they assumed a linear relation of researchers, extension workers and farmers with organized public funded research as the major source of technology. Such transfer of technology models were usually found top-down in structures and the responsibilities were often confined with the Ministry of Agriculture. One of the examples is the Training and Visit (T&V) system which was promoted by the World Bank in 1970s. Though this system was initiated as the reform to public sector extension service systems, it later on emerged as a major model for knowledge dissemination and extension management in the developing countries. As a result, the T&V system of technology transfer management process received mixed response in some countries. However, there are evidences highlighting the shortfalls in T&V system. One of them was the supply-centeredness and top-down nature of the model which promoted mainly those farm-related messages which were designed and delivered by research scientists, with minimal input from the technology users. Moreover, the assumption of large scale expansion of message by the group of contact farmers did not realize in many cases.

The practitioners of extension service delivery though were blocked in technology diffusion only; broader exercise on the nature of agricultural technology development and dissemination started gaining response since the last two decades. It is now greatly appreciated and realized that innovations may originate from multiple sources, including farmers. Therefore, the farmer participation in technology design and client's participatory extension approaches emerged. The notion of extension as part of a wider system has emerged, for example, the 'interdependence model'<sup>6</sup> and the 'innovation systems framework'<sup>7</sup> offered more inclusive ways of thinking about the institutional context in which the generation, diffusion and use of new knowledge takes place.

With the globalization of agriculture, emphasis on productivity and profitability to the farm enterprises increased and, therefore, approach of production-led and market-led extension becomes indispensable<sup>8</sup>. For farmers, as the extension system is more credible source of farm technologies, the extension personnel ought to be knowledge- and skill-oriented in relation to production and marketing of agricultural goods. Thus, revamping the extension system will have a catalytic role for ushering in farmer-led and market-led extension<sup>9</sup> which can sub-

sequently alleviate poverty. Samanta<sup>10</sup> highlighted the importance of institutional reconstruction and renewal and decentralized extension structure. Recently, many developing countries have reaffirmed the essential role that agricultural extension can play in agricultural development as pointed out by Birner and Anderson<sup>11</sup>.

From farmers' perspectives, their categorization based on the holding size and targeting the interventions accordingly carries no sense at least in the current context of India. Though Chambers<sup>12</sup> evolved the concept of Farmer First comprehending the three broad categories of agriculture, i.e. industrial or specialized, Green Revolution or well endowed and the CDR or Complex, Diverse and Risk-prone, the same has not yet been institutionalized in the agricultural policy domain of the state and country. Thus, the linear pipeline approaches and methods of transfer of technology (TOT) for the uniform and controlled conditions of industrial and green revolution agriculture were appropriate but did not fit CDR conditions and farmers' practices were seen as adaptive performance, i.e. the proposition that the technology adoption by farmers is its validation albeit the comparative edge of farmers over scientists in innovating for complex and diverse systems were ignored. Farmer First was established as paradigmatically different from TOT, and as a pivot for CDR agriculture. It establishes itself as a movement. Five years later, in 1994, Scoone and Thompson<sup>13</sup> mooted the concept of Beyond Farmer First which further broadened and complemented Farmer First approach; endorsed the pluralism of knowledge sources; recognized knowledge not as a stock but a process; appreciated farmers, extensionists, scientists and others as social actors/stakeholders; added political dimensions and power relations as important factors and elements of a neo-professionalism in farm extension science. A workshop was held in 2007 on Farmer First Revisited which contradicted the philosophy of original Farmer First. Whereas in Farmer First, marginalized innovators were aggressively recognized and the solidarity of heretics having a common commitment prevailed; in Farmer First Revisited, it was focused how far we had come, how many more domains than just farmer participation were relevant, and how rich the range of innovations had been. Secondly, in Farmer First the focus was on the complexity and diversity of farming systems and the creativity of farmers; Farmer First Revisited emphasized the complexity and diversity of action domains and interventions, their relationships and the co-creativity of many different stakeholders.

Thus, it could be inferred from the above that the trends in evolution of extension model, approaches and methodologies were highly dynamic at global and national level. This is indicative of need for continuous experimentation, adaptation, application, discontinuance and reconsideration of farm extension model if the farming community and other stakeholders to be served better.

## Adaptation of frontier technology transfer systems

The Indian Council of Agricultural Research (ICAR) initiated extension education programme with the National Demonstration Programme in 1966 followed by the Operational Research Programmes (1974–75) and Lab to Land (1979) which was implemented by ICAR institutes and State Agriculture Universities (SAUs) in their contiguous operational areas with the active participation of research scientists. All of which, however, were merged with the KVKs during 1990s with new structural and organizational arrangement. At the same time, SAUs also started extension activities in the form of trainings, demonstrations, exhibitions, etc., confined to limited area which was further strengthened with the establishment of Directorate of Extension in each SAUs. Other significant initiatives by ICAR included Institute Village Linkage Programme (IVLP) which was started in 1995 and evolved as technology assessment and refinement (TAR) through IVLP in 1999, single window information and service delivery through Agricultural Technology and Information Centres (ATICs) and the recently launched (2006) National Agricultural Innovation Project (NAIP). However, among all the projects and over the years since 1974, the KVKs have grown as the single largest network of frontline extension system in the country with a quantum jump in number reaching to 643. The main mandate of KVK is technology assessment and demonstration for application (TADA) and capacity development (CD). The activities of KVKs are on-farm testing of agricultural technologies under various micro-farming systems, front-line demonstrations to show production potentials of technologies on the farmers' fields, training of farmers to update their knowledge and skills in modern agricultural technologies, and training of extension personnel to orient them in the frontier areas of technology development and to work as resource and knowledge centre of agricultural technology for supporting initiatives of public, private and voluntary sector for improving the agricultural economy of the district.

Recently, ICAR has initiated the innovative frontline extension approach of 'Farmer FIRST-Enriching Knowledge-Integrating Technology' in the XII Five-Year plan which contemplates to move beyond the production and productivity and to focus on the small holder agriculture and complex, diverse and risk-prone scenario of majority of farmers through enhanced farmer–scientist contact. This approach embeds farmer's farm, innovations, resources, science and technology (FIRST). Also, the two innovative terms 'enriching knowledge' and 'integrating technology' qualify the meaning of Farmer First in Indian context. Besides, ICT supported voice KVK (vKVK), KVK net, *krishi dak*, *Mera gaon-mera gaourav*, attracting and retaining rural youth in agriculture (ARYA) and per drop-more crop are new initiatives for bringing greater visibility to frontline extension of India.

## Global adjustment in public agricultural extension system

### *Case of China*

The government of China re-established its Public Agricultural Extension System or PAES during late seventies. After ten years, this system employed extension staff to the tune of more than one million<sup>14</sup>. Also, more than 70% of these staff members were graduated from technical high schools or colleges<sup>15</sup>. As high as more than 90% of them served the PAES stations from county and township levels, with highest concentration at the township level. By the mid-1980s, China has established such stations across the rural county and township, even in remote areas<sup>16</sup>. As a result, such large and inclusive system provided high-quality agricultural extension services (AES). Comparing to the 1.01 million of agricultural extension agents, there were only 0.74 million of agricultural administrative villages. And thus, at that time one extension agent was usually tasked to provide technology services to farmers across 3–5 villages.

However, the continuous spread of such specialized stations made PAES overstaffed. In the early 1990s, therefore, the Chinese government initiated a series of reforms to make PAES economically viable and sustainable. The commercial reforms was the first reform which categorized these stations according to their source of funding into fully funded stations, partially funded stations, and self-funded stations. Counties had flexibility in how to implement the reforms, and in some counties that were less able to finance agricultural extension all the PAES stations have become self-funded or partially funded stations. Cuts in funding for PAES affected the day-to-day operations of the system. Studies have reported that services were greatly reduced since the early 1990s<sup>17</sup>. Other reforms included – the administrative decentralization reform and inclusive public agricultural extension system reform.

There are four distinct features of these reforms: they considered all farmers as targets for public extension service, adopted a systematic approach to identify the local farmers' needs, enhanced accountability of the extension agents for providing services and made provision of incentives for the extension agents in lieu of their services. These features made the service providers (extension agents) understand better what extension services farmers actually demanded.

### *Case of USA*

The Cooperative Extension Service (CES) is a powerful institution in the USA and there is presence at land-grant universities and colleges in the states. As the country's population has changed over the years, historic links of

colleges of agricultural and human sciences with the US Department of Agriculture have expanded to include partnerships across the educational enterprise of the university and to several other federal agencies. The deep connections to citizens at the grassroots level are fostered by close relationships to local and county governments. The local-state-federal partnerships now include new relationships that take educational efforts into all communities and neighbourhoods across the USA. Extension's potential of USA is bounded only by its imagination and creativity. As a result, CES focused on strategic opportunity areas like sustainable and profitable plant and animal production systems; preparing youth, families and individuals for success in the global workforce; creating ways out to energy independence; ensuring an abundant and safe food supply for all; assisting in effective decision-making regarding environmental stewardship and helping communities in becoming sustainable and resilient to the uncertainties of economics, weather, health, and security and lastly enabling families, youth and individuals to become physically, mentally, and emotionally healthy.

For accomplishing the above strategic opportunities, CES addresses the internal organizational challenges of bringing greater flexibility and agility in identifying and serving residents with diverse backgrounds and needs, strengthening and diversifying the funding streams for extension priorities and improving the quality and skills of extension personnel.

The above cases may help the practitioners of extension services in India in the following ways: (i) The cost sharing in lieu of the rendered extension services needs to be experimented and institutionalized for selected enterprises/commodities for the selected states of India. (ii) The competency of private sector extension service providers like input dealers and other agri-business houses need to be upgraded with planned strategies designed and executed by the public sector research and extension systems. (iii) The functional linkages between central and state level extension machineries need not be only ritual in nature, rather such relation should be more meaningful, focused, operational and vigorous.

### Transitions in Indian agricultural extension system

Both developed and developing countries have initiated major reforms in public funded extension systems. Policy institutions in less developed countries have suggested for investing large share of budget in public sector extension. However, they are achieving uneven impact, often at unsustainably high costs. Further, the public sector extension institutions hypothesizes that low-income group farmers may not be interested to procure modern technical information and knowledge of agriculture unless it is subsidized by government. Therefore, several other

factors, viz. lack of fiscal sustainability, poor coverage and performance, changing contexts and opportunities and pressures towards participation and good governance<sup>18,19</sup> argue for reassessment of conventional role of public sector agricultural extension.

As the national governments and international agencies are continuously advancing the structural, financial and managerial reforms to improve extension<sup>20</sup>, agricultural extension is in the state of move. Few such reforms among them are decentralization, pluralism, cost sharing, cost recovery and participation of stakeholders in extension process. The implementation of many of these reforms is influenced by the extent of understanding of its role and function, partnerships among different actors, available expertise and an explicit agenda on institutional learning. Thus, extensions have transformed from mere technology dissemination to the increased emphasis on helping farmers to organize themselves, linking them to markets and value chains<sup>21-23</sup> and providing them environmental and health-related information services. Extension has now become the part of agricultural innovation system<sup>24</sup>. There is no single recipe for reforming extension. Nonetheless, a number of lessons could be learned from the strategic decisions and their varied impact.

When the T&V system was terminated from India, it became a tough task to evolve a viable and alternative approach by the Department of Agriculture (DoA), the main extension agency of India. Numerous deficiencies in the public sector extension in India were documented<sup>25-27</sup>. Still, the predominant modes of extension remain public funded and publicly delivered. There was sharp mismatch between the requirements of farmers and rural families and extension's emphasis which was mainly on the transfer of crop production technologies. Consequently, the approaches remained confined to the linear model, i.e. Roger's diffusion of innovation model despite its severe criticism<sup>28</sup>.

The research (i.e. technology development) and extension (i.e. technology transfer) to farmers were performed by two separate and tightly defined organizations with mutually exclusive roles. Such organizations also did not have strong structural and functional linkages with other public agencies with allied roles in the agricultural and rural development sector. Coordination and linkages between ICAR and SAU systems and State Department of Agriculture for extension activities were also reported to be weak<sup>26</sup>.

### Major Indian initiatives

In India, public sector research and extension had demonstrated their worth in enhancing the production and productivity in agriculture and allied sectors in the past. Since then, the intent and purport of agricultural extension has undergone basic fundamental changes.

Translating research output as per farmers' circumstances has become an important challenge today. Consequently, the frontline extension system and also the main extension system by the Department of Agriculture and Cooperation (DAC) have initiated measures to revitalize the agriculture extension system in India. Some of them include:

### *Innovations in agricultural extension*

Reorienting the skills and activities of extension personnel more towards rural people mobilization, conflict resolution, problem solving, adult education and human development has been the emphasis of extension organization since last decades<sup>25</sup>. Considering the absent market link and the failure of state extension system, community-based approaches involving farmers' interest groups are gaining appreciation in recent years as a potential alternative. The Indian states are now experimenting with different innovative extension initiatives. For example, Maharashtra shifted to single window system and merged the Departments of Agriculture, Soil and Water Conservation and Horticulture at the operational level. Kerala also decentralized the working of Department of Agriculture and created offices of DoA (Krishi Bhavans) in all panchayats. It also initiated the farmer interest group approach in rice farming which was out scaled to other crops and enterprises. Punjab had been continuing with the University–Farmer direct contact method over the past two decades and the frontline extensionists were upgraded to graduate level. Andhra Pradesh has also established District Agricultural Advisory Technology Centers in all the districts for technology refinement, diagnostic visits and for organizing field programmes in collaboration with DoA and allied departments.

Community-based extension (CBE) is often seen as more practical approach as it surmounts both the state failures and the market failures which were inherent in conventional extension<sup>29</sup>. Most of the developing countries are hard pressed with poor farmers-to-agent ratio (more than 1000:1); hence, farmers often find it tough to exercise their demand and making extension service providers accountable in the want of some farmers' organization<sup>30</sup>. Such institutions may have prompting role in aggregating farmers' demands for extension services and in enabling their enhanced representation in extension management thereby making extension more demand driven<sup>31</sup>. The farmer centered FFS (Farmers Field School) for delivering information and educational services was initially designed to introduce integrated pest management (IPM) related knowledge among Asian farmers, but slowly it was expanded to several countries, covering various other agricultural themes<sup>32</sup>. FFS capacitates farmers for particular technological issues related to their crops and the bio-physical environment. This approach

ensures farmers' participation at the stage of information delivery where the extension personnel interact more closely with the farmers. However, extension agencies may also utilize farmers' groups in FFS at later stages of the extension delivery chain, especially for linking them with financial institutions. Another approach – Agricultural Technology Management Agency (ATMA) – also ensures farmers' involvement in all stages of the extension delivery chain<sup>31</sup>. Of late, the institutional integration model utilized in extension delivery systems like 'Mahamango', 'Mahagrape', 'Mahahorti' in Maharashtra; 'AMUL' in Gujrat and 'Farmer Innovations' in Andhra Pradesh needs large scale replication for horizontal expansion of the benefits.

### *Support to state extension programmes*

This scheme was launched during 2005–06 and it works for making extension systems more farmer-driven and accountable through novel institutional structure for technology delivery at the district level called ATMA. It has the multi-stakeholders involvement of farmers and farmers' groups, VOs, KVKs, Panchayati Raj Institutions (PRIs) and other related institutions functioning at district level and below. The fund release design by ATMA is based on State Extension Work Plans (SEWPs) prepared by the concerned State Governments. For ensuring the contemplated reforms to be suitably addressed, the following structural parameters are enunciated in ATMA:

*Multi-agency extension strategies:* Apart from the Government extension machinery, at least 10% of ATMA budget on recurring activities at district level is to be allocated to non-governmental sector operational in the form of NGOs, farmers organizations (FOs), PRIs, para-extension workers, agricultural entrepreneurs, input suppliers, corporate sector, etc.

*Farming system approach:* The extension needs of the district are identified scientifically through Strategic Research and Extension Plan (SREP). And accordingly, the development activities are designed and delivered in consistency with a farming systems approach and extension.

*Farmer-centric extension services:* ATMA generally focuses on group-based extension and it also makes adequate allocation for activities for organizing and promoting farmers' groups. For supplementing these efforts, performance-linked rewards and incentives for the best organized farmer groups are envisaged.

*Convergence:* For ATMA, convergence of all extension activities is ensured through SREP and SEWP. Currently, resources for extension activities are being allocated through various Central/State Governments sponsored

schemes. It is mandatory that the SEWP ought to explicitly specify the interventions to be supported from the resources of other ongoing schemes as well as from ATMA.

*Mainstreaming gender concerns:* ATMA has the mandate to ensure at least 30% of resources to be utilized exclusively for women farmers. In addition, 30% of resources are also to be used for female extension officials.

*Sustainability of extension services:* In order to make the agency sustainable, it is made essential for the prospective beneficiaries to contribute minimum of 10% of total cost of the activities oriented to them.

### **Shifting the operational paradigm**

In Indian context, tremendous global development necessitates the reforms in agricultural extension. These developments are mainly in the areas such as free global market accessibility and market liberalization, cost sharing, emergence of multi-stakeholders, power and responsibility sharing, greater say of clients in decision-making, natural and man-made epidemic and endemic, information abundance, etc., which necessitates for inclusive, multi-disciplinary, holistic and sustainable development. Some of the major learning for India's extension systems as emanated from the reforms at global fronts may be enumerated as below.

#### *Beyond technology*

The current extension systems mainly concentrate on 'Production Technologies' such as crop varieties, fertilizers, plant protection chemicals, etc. with an aim for productivity enhancement. This approach addresses partially to the whole requirements of the clients. The supporting 'Knowledge' and 'Services' and other 'Logistic and Infrastructure' development need of the farmers are seldom looked into and farmers, in turn, have to either arrange these requirements themselves or to drop the idea of doing something innovative and cutting edge. For example, the real case of a farmer in Uttarakhand, India has revealed that when he planned to establish the commercial dairy farming with 100 milking herd of pure Holstien Frisien (HF) breed of cattle with state-of-art machinery and supporting logistics, he did not find any department or agency to support him technically or otherwise. He himself had to think about the project and approach many trans-national firms engaged in such venture. Of course, at last he emerged as the successful entrepreneur of commercial milk production and processing, but this indicates the grey areas for India's extension systems.

#### *Beyond single commodity*

Most of the subject matter experts working with extension departments are comfortable with single commodity or enterprise. On the contrary, the situation and problems of the farmers are interwoven with enterprises and their interdependencies. Hence, the extension with integrated and farming system-based approach cannot be ruled out particularly for the resource-poor farmers of India. This can be further elucidated that a farmer may have problems and needs related to crop or weather or market information or livestock diseases, financial institutions, etc. either singly or in combination. Under such scenario, the existing 'one-expert-one-enterprise' model may not work. Therefore, the institutional arrangements in the format of community development and integrated development approach once in operation during early fifties to early sixties ought to be revisited.

#### *Strong farmer-extension research linkages*

For any farm technology to be appropriate to the given production situations, farmer's need, his resource endowments, and market demand, it has to be evolved with strong partnership of farmers with research. Similarly, the farm messages need to be designed keeping the clients' level of understanding the contents, its timeliness and relevance. Hence, farmer participatory technology development (research), technology adaptation (extension) and message/content management (extension services) may be institutionalized as the three cardinal pillars for any successful extension programme, at least in Indian context.

Therefore, mitigating the contextual, organizational, policy level constraints and associated bottlenecks of global origins, the following principles may be basis to draft the robust extension policy: (i) a sound state and national agricultural policy, (ii) Extension necessarily ought to mean 'facilitation' rather than 'technology transfer', (iii) Producers are not the beneficiaries rather a partner, sponsors and stakeholders, (iv) Market to act as relationship bridge between farmers and goods and services suppliers, (v) New perspectives for public funding and (vi) Pluralism and decentralized activities through coordinated dialogue among the actors.

### **Potential alternatives**

For alleviating the above crises, India's extension system has started to experiment major adaptations since the late twenties. These changes are with respect to policy framework, institutional structures, stakeholders' capacity, improving organizational management and enabling methods of extension system. The targeted changes include the decentralized extension service system (state to

the local level), provisioning the pluralistic and participatory extension, skill empowerment of farmers, and capacity training of service providers to respond to the demands of farmers<sup>29,33,34</sup>. The organizational development interventions have to inculcate the work related ethics among the extension functionaries for translating the alternative of 'beyond technology'. Thus the necessary support by making the government schemes and policy farmer friendly, accessible and affordable, less time consuming with lesser number of working channels involved ought to be put on ground for building confidence among the farm operators. The reform initiatives are to be manifested in the form of improved agricultural productivity through demand-driven, farmer-accountable extension system which also to address the need, purpose and target-specificity. It has been thus concluded that there is no single optimal or best model for providing need-specific, purpose-specific and target-specific extension services<sup>33</sup>. Albeit, the single commodity approach has to be transformed to more holistic and multi enterprise based, with more focus on every component, i.e. bio-physical, socio-economic and household-related factors. The ultimate choice of the agricultural extension approach shall be the function of policy climate, capacity of service providers, farming systems characteristics, market accessibility of farm households, and lastly the nature of the local communities and their sense of mutual cooperation.

It has been established that there has to be a perfect match of farm extension approaches and given sets of farm conditions. In order to use extension approaches that fit well in a particular situation, the prerequisite for given agricultural extension system to be adequately accommodative to various options cannot be ruled out. The recent agricultural-sector reforms geared toward creating a demand driven, broad-based and holistic agricultural extension system hints towards the above requirements<sup>6,35</sup>. Thus the multiple integrated measures have been introduced which enable service users to voice their needs on one hand and hold service providers accountable on the other. Also, on the supply side, capacity of service providers to respond to the needs of the extension service users (farmers) is also influenced. Modernizing the agricultural innovation systems implies building institutionally sustainable innovation systems with growing interrelations between the actors in the innovation system, an intense communication among them and a strong 'social embedding'<sup>36</sup>. Therefore, considering the major global reform trends of decentralization, contracting, cost-recovery, cost sharing and the involvement of NGOs and farmer-mobilized organizations, the key concern for designing a pluralistic service can be possible through the appropriate 'mix' of public and private funding and delivery mechanisms for extension, which could accomplish the diverse agricultural goals and serve the heterogeneous target populace effectively.

### Future options

To address Indian farmers' dynamic needs for information and advisory support, extension has to engage with an array of issues related to agriculture and allied fields. These are markets, finance and insurance, besides the technology and research support and arrangements for the adequate and timely supply of quality inputs<sup>37</sup>. The function domain of extension now requires to address the diverse issues like reducing vulnerability of all kinds, promotion of micro-enterprises, poverty alleviation, environmental conservation and farming and strengthening farmer-led institutions<sup>38</sup>. The multi-institutional approach has to come in operation keeping in mind that farmers mostly receive information from different sources and, that some organizations specific to farmers' categories while reaching to them. Thus, there will be situations demanding diversified strategies employing multiple-mixed approaches. No single institutional arrangements, therefore, shall be the pre-dominant form of reorganized public sector agricultural extension systems. Thus, the key indicator for reforming national extension systems will be to make it an effective instrument promoting the innovation, knowledge and facilitation of development<sup>39</sup>. In this context, research into use (RIU) by the United Kingdom's Department for International Development may offer the potent platform for revamping and taking off the extension programmes of India through six overlapping yet competing innovation narratives, viz. (i) poor user-centric innovation models, (ii) public private partnership-led innovation models, (iii) capacity development-led innovation approaches, (iv) below-the-radar-led innovation approaches, (v) investment-led innovation approaches and (vi) research communication-led innovation approaches. On one end, the market-driven strategies vital to production and value chain development and on the other end, the knowledge intensive strategies vital for development of human capacity and institutional upgradation are the core overhauling the Indian agricultural extension machineries. The challenges before public sector agricultural extension and their redressal are no longer an issue of a system in transitions rather a phenomenon. One critical issue for the small holder farmers is whether support to be ensured for the development of markets or whether extension has to take a supportive role in heralding smallholders to develop contractual/cooperative arrangements for effective market systems. Another important issue is whether government to develop and expand institutional network as a resource for capacitating its extension workforce or some other options to explore out. The two decades of criticism and putting reforms of extension services in places, a new role recognition for the public sector extension has emanated the diverse strategies for agricultural extension. Knowledge empowerment has to be more vibrant vis-à-vis capital investment. The traditional school of TOT using personal

contact has to be no longer the predominant option of extension. The diverse needs of information by farmers are confined not only for production packages rather also for quality production, documentation, processing, packaging, storage, transportation and other facets of post-harvest handling. To achieve more rapid farm growth, both research and extension need to be strengthened. There is nil chance of any silver bullets or a unique model that may enhance the extension performance in Indian context. For scaling up the wide range of objectives and target groups, the Indian state has to employ a wide range of approaches. Embedded extension services required to be fortified with input supply and contract farming by the private sector, and there is need to work well for medium to large farmers in well-endowed regions. Community-based method specifically holds immense potential for natural resources management and involvement in managing common property resources as well as the value chains. Mobile enabled information dissemination will become part of or shall complement well to all other extension services. Hence, to derive advantages to the fullest extent in moving to pluralistic systems, comparative advantages and specific functions of different actors have to be well comprehended and utilized.

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