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Scaling up Innovative Agricultural Extension Models

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Preface

Agricultural Extension in India is pluralistic in nature with broad typology of field extension and front line extension. The field extension is concerned with large scale technology dissemination to the stakeholders by development departments whereas the front line extension is implemented by the ICAR and Agricultural Universities, and focuses on bringing desirable behavioral change through demonstration, technology adaptation, and capacity development of farmers and other stakeholders.

The extension programs became more organized and systematic in the post-independence period. ICAR has been pioneer in leading the front line initiative through National Demonstration Project (1964-65), Operational Research Project (1972), Krishi Vigyan Kendra (KVK) (1974), lab to Land project (1979), and Farmer FIRST, ARYA and MGMG (2016) programs.

The role of agricultural extension in technology delivery has been challenging in the recent past, which has necessitated innovation in the process for real transformation of the rural environment.

Such innovations can be individual driven with the involvement of Agriculture Startups, cooperative driven as in case of IFFCO, NGO driven, and Government driven. There is a need to draw a road map for improving policies and extension approaches to address issues for up scaling innovations in extension. To deliberate on this issue, the National Academy of Agricultural Sciences (NAAS) organized a Brainstorming Session on “Scaling up Innovative Agricultural Extension Models” on September 12, 2022. A number of issues, priorities and strategies for up scaling of innovations were discussed. This policy paper describes some of the innovative approaches and suggests key strategies for their up-scaling.

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(Trilochan Mohapatra)
President, NAAS

Scaling up Innovative Agricultural Extension Models

1. INTRODUCTION

The broad typology of agricultural extension in India is Field and Frontline Extension Systems. The field extension system refers to large-scale agricultural technology dissemination to the farmers by development departments and agencies; whereas, frontline extension system is implemented by the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs), which focuses on the adaptation and demonstration of the technologies and capacity building of the farmers and other stakeholders. There are four major players of agricultural extension system *viz.*, the Department of Agriculture Cooperation and Farmers Welfare (DACFW) and the related ministries of rural development through its network of agricultural and related departments at state, district, block and village level; National Agricultural Research and Education System (NARES) consisting of ICAR and Agricultural Universities primarily through Krishi Vigyan Kendras (KVKs); and different Commodity boards, Agribusiness houses, input agencies and voluntary organizations of the country. Frontline Extension is a catalytic force for bringing desirable behavioural change, which involves higher level of technology centric interaction by qualified staff of the research and education system. It is based on the hypothesis that the scientists who have generated the technologies can demonstrate the technologies better to the farmers in their fields.

The post-independence extension programmes and interventions have been more organized and systematic. The ICAR started major front-line extension projects, viz. National Demonstration Project (1964-65), Operational Research Project (ORP) (1972) and Lab-to-Land Project (LLP) (1979). Another significant development in front-line extension was the establishment of the first KVKs in 1974. National Demonstration (ND) on major food crops was launched in 1964-65. The rationale behind the scheme was that unless the scientists could demonstrate what they advocated, the farmers might not heed their advice. It was a nationwide program with uniform design and pattern. The demonstrations were intended to show the production potential of new technologies and to influence both the farmers and the extension agencies. This project did play its role in the success of the Green Revolution in India. All the three previously launched frontline extension programmes i.e., ND, ORP and LLP were merged with KVKs. The KVKs aimed

to improve technical literacy of farmers including rural youth and women on the principle of 'learning by doing' and ‘teaching by doing’. The KVKs are currently hosted by the ICAR institutes, Agricultural Universities (AUs), Non-Governmental Organizations (NGOs) and State Government Departments with financial support and guidance from the ICAR.

2. PRIORITIES IN AGRICULTURAL EXTENSION IN INDIA

In the transforming agri-rural environment, the role of agricultural extension, education, and technology delivery system has also changed. Harnessing advances in the frontiers of science in selected priority areas with larger spin-off benefits by focusing on basic and strategic research also assumes significance. Need has been felt to search for alternatives to the public agricultural extension and information system in the country. A paradigm shift from the single discipline orientation to multi-disciplinary approach is critical for research in the area. According to the National Commission on Farmers (NCF), the farmer-to-farmer learning and technology transfer is most frequent and is found to be reliable. Farm schools at the farms operated by progressive farmers should be organized in large number in different agro-climatic zones and farming system regimes. Farm School and Farmer Field School can be effective tools in farmer-led extension system. It has become absolutely necessary to shift focus of extension system from being production-oriented to becoming market-led, for increasing farm income. Market-led extension helps the farmers to minimize the production costs, improve the quality of farm produce, increase the product value and marketability, and realise higher income. Thus, linking farmers to markets is necessary for augmenting farm production and farmers’ income. The role of innovative institutions would be critical in this context to reap the benefits of emerging opportunities. Convergence among the partners of pluralistic extension is also a key issue for the future extension More of “Collegiate Participation” is important where different partners work together as colleagues or partners. Ownership and responsibility are equally distributed among the partners, and decisions are made by agreement or consensus among all actors.

Currently, efforts are being made to institutionalize research-extension linkages at the national, regional, state, and zonal levels. At the national level, under the ICAR-DAC interface, joint meetings of officers from ICAR and Department of Agriculture and Cooperation (DAC) are being organized twice a year to discuss the critical research and development issues. At the regional level, eight regional committees of ICAR comprising of senior research and extension officers, farmers’ representatives, and NGOs, meet once in two years and interact with State

officers to provide solutions to problems with adequate technology and information for necessary actions and implementation in the states. The Zonal Agricultural Research and Extension Advisory Committee meetings and seasonal workshops at the zonal level facilitate close interaction between researchers, extension workers, and farmers. Thus, technology development and delivery happen in a continuum.

3. FRONTLINE EXTENSION- DIFFERENT APPROACHES:

A number of innovative extension approaches have been developed, validated and implemented from time to time for enhancing outreach of extension and carrying out technology delivery to the stakeholders.

The Krishi Vigyan Kendras (KVKs) or the Farm Science Centres are regarded as an institutional innovation approach that has effectively linked agricultural research and extension at the district level in India. As of now, ICAR has established 721 KVKs across the country, which are the key institutional system at district level for technological backstopping in agriculture and allied sectors. KVK is the fulcrum of the district level coordination between various implementing agencies and programmes like ATMA, line Departments, on-going schemes/ programs, Gram Sabha members, Panchayat institutions, other Government and NGO players in the field of extension. KVKs serve as a Knowledge and Resource Centre of agricultural technologies for supporting initiatives of public, private and voluntary sectors in improving the agricultural economy of the district. The need to redefine agricultural extension system in the country is not merely a techno-social system of supporting farmers to grow more, but also for enhancing income from farm, off-farm and non-farm activities.

Krishi Vigyan Kendras are providing a high rate of return on expenditure. Impact study of KVKs revealed that KVKs' efforts generated an additional average net farm income of Rs. 3568 per hectare. Cost:Benefit ratio for investment on KVK is very high at 1:12. One farmer trained by a KVK disseminates technology/knowledge to ~30 fellow farmers. The agenda for future reforms in extension in India will include further decentralization, flexibility, convergence, fostering public-private partnerships, emphasis on better research-extension linkages, strategy for human resource development, gender mainstreaming, financial sustainability and strong monitoring and evaluation mechanism.

Farmer FIRST programme, a new initiative of ICAR, aims at enriching Farmers –Scientist interface, technology assemblage, application and feedback, partnership, institution building and content mobilization. It provides a platform to farmers

and scientists for creating linkages, capacity building, technology adaptation and application, on-site input management, feedback and institution building. The project is under operation in 51 centers under ICAR and SAUs spread across 20 states of the country. The scientists, under this project, are working with 48291 farm families under different models namely, crop, horticulture, livestock, NRM, IFS and agro-enterprises.

Attracting and Retraining Youth in Agriculture (ARYA) was initiated recently by ICAR for developing entrepreneurial skills in youth so that regular income flow could be realized by establishing small enterprises. Twenty-five districts in 25 states were identified for programme implementation. under ARYA has Under ARYA, as many as 930 different enterprise units were established during the last two years benefitting 2467 rural youth in the selected districts. Skill training was given to 3879 rural youth through 92 various training programmes pertaining to the enterprise units allotted to each ARYA centre. Eight exposure visits to different successful enterprise units were arranged to 327 youth as training and confidence building measure.

Farmer Producer Organizations (FPOs) are being promoted both by the public and private sector extension systems. FPOs not only ensure a bargaining edge to farmers but also reduce the costs of cultivation, processing, value addition and marketing, thus leading to higher sale volume and remunerative prices. The cooperative principle underlying the FPOs makes them democratic, thereby overcoming the tyranny of big farmers. However, these need guidance, support and handholding to start and sustain their business. In this approach, technology backstopping is to be provided by the frontline extension system. Region wise reliable database needs to be created to understand the need of the farmers and other stakeholders in totality, their level of understanding, their progressiveness with regard to adoption and the rate of adoption in different regions.

'*Mera Gaon Mera Gaurav*' (My Village My Pride) was launched in August 2015. Under this program, a group of 4 scientists, each belonging to different disciplines from ICAR Institutes and agricultural Universities, adopted 5 villages for giving suitable advice to the farmers on technical and other related aspects within a stipulated time frame through personal visits or by telephone. Scientists are also creating awareness among farmers about climate change, other customized technologies, protective measures, Swachh Bharat Abhiyan, and other issues of local and national importance. In this process of socio-techno transformation, scientists also involve local Panchayats, development agencies, NGOs and private organizations. The objective is to effectively promote direct interface of scientists

of ICAR Institutes and State Agricultural Universities with the farmers to hasten the lab to land process. The project is intended to connect with 25,000 villages. Agricultural scientists are providing information on newer technologies to the farmers in 13,500 villages.

Nutri-sensitive Agricultural Research and Innovations (NARI) focuses on empowering farm women with key areas like innovative practices to promote nutrition-sensitive agriculture, awareness and capacity development of various stakeholders, value chain, literacy campaign, etc. Nutri Smart Villages in Madhya Pradesh have been launched by the State Government with the firm belief that villages can be relieved of malnutrition through agriculture and subsidiary activities like animal husbandry and fisheries in coordination with the Krishi Vigyan Kendras. **Knowledge System for homestead Agricultural Management in Tribal Areas (KSHAMATA)** was initiated keeping in view the importance of the tribal agriculture, in 125 districts where tribal population is 25 per cent or more to facilitate technology support and related inputs to the tribal farmers located in remotest places. **Value Addition and Technology Incubation Centre in Agriculture (VATICA)** has been conceptualized by ICAR to create a facility to provide incubation training to rural youth in processing and value addition. ICAR, is providing funding support to create 3-4 units as model units in the KVK campuses.

Pashu Sakhi is a Community Animal-care Service Provider (CASP), which enables the last mile coverage in rural areas, where clinical services for livestock is not available on time or is expensive to afford for rural poor. Pashu Sakhi is envisaged to create awareness and carry out capacity building of the community on livestock-based livelihood activities, and facilitate aggregation and marketing of the livestock products. Anganwadi workers are also engaged as change agents for promotion of nutritional security.

4. ICT BASED TECHNOLOGY DISSEMINATION

Indian Agricultural Research Institute (IARI) came up with the innovation of multimedia-based information delivery through social media platform giving crop based seasonal management information and weather information as well as problem-specific solution through multimedia-based extension model named ‘Pusa Samachar’ for two-way information sharing through social media. One dedicated Pusa WhatsApp number has been launched, in which farmers are sending their farm problems with pictures and scientists are replying promptly. Kisan Sarathi (System of Agri-information Resources Auto-transmission and Technology Hub Interface), an intelligent online platform has been launched by ICAR to provide a

seamless, multimedia and multi-ways connectivity to the farmers with the latest agricultural technologies and knowledge base through a pool of a large number the subject matter experts. Kisan 2.0 is a hub of 117 mobile applications developed by several ICAR institutes on various commodities for providing customized advisories and extension delivery to the stakeholders. A number of Agri-startups are also providing customized 360^{o} support to the stakeholders including selection of crops, crop management, weather information, marketing of produce through geo-tagging.

5. AGRICULTURAL EXTENSION SYSTEMS OF DEVELOPING WORLD

South east Asia, especially Cambodia, Thailand and Indonesia, and to a lesser extent, Vietnam and Philippines, utilize a mix of government-based and pluralist (government and private sector) approaches to extension. The shift from 'push' to 'pull' based models of public extension, coupled with shifts towards more market-based economies, has resulted in the 'green revolution' in many parts of Asia with significant three-fold productivity increase since the 1960s, mostly on the basis of input subsidies. The principal mode of government support is the commune extension worker (CEW). In Cambodia, current extension includes a pluralist one, emphasizing 'pull' based approaches. Despite the various efforts in place, agriculture extension is considered ineffective, with low economic margins despite yield increases. Unlike the ATMA reform in India, Provincial agriculture department extension sub-program (PAD) services can be provided by NGO and private sector workers, with a required co-investment. Vietnam initiated a more decentralized demand-driven and liberalized approach to agriculture following economic reforms. Through the Ministry of Agriculture and Rural Development and related provincial and district level departments, the government invests in CEW. A review of Central American agricultural policy (FAO 2011) showed that public sector support for extension has been mixed. In central Latin America if has been limited to supporting co-operatives and famer-to-farmer approaches, in the Caribbean, extension has been provided by government (emphasizing Integrated Pest Management, Business development, ICT use and seed security) either through organizations with research and extension services, or through individual government departments that support research and extension on a sectoral basis, but lack opportunities for coordinated evidence base that supports best practice extension service provision matching farmers needs. More recent studies in Latin America highlight a shift towards private and public 'pull' based approaches to extension, emphasizing micro-finance mechanisms and information technology.

Of all the regions, Africa has the widest variety of public-private extension models (Wongtschowski et al., 2013). In almost all cases, extension provider organizations are involved in a range of funding schemes. Extension services funded by the public sector often involve the distribution of vouchers for services by input providers, produce processors or exporters. There has been a mixed success with these types of schemes.

6. PERTINENT ISSUES

Several of the institutional innovations that have come up in response to the weaknesses in public agricultural research and extension system, have provided enough indications of the emergence of an agricultural innovation system in India. Up-scaling and out-scaling of these innovations are critical for Agricultural extension to play an important role in facilitating knowledge generation, its access, and transfer across regions. A robust agricultural extension policy is essential for ensuring convergence in the pluralistic system to design stakeholders' coordination mechanism and framework. The policy should also spell out who will provide what kind of product or service to whom and at what quality. Long-term commitments, capacity building of stakeholders and a strong system for formative and summative evaluation are indispensable prerequisites for successful implementation of convergence, and should be integral part of any extension system and development programmes. If all the agricultural extension organizations are converged at different levels according to their relative advantage area, farmers will be motivated and mobilized to adopt better technologies provided by the coordinated and converged extension approach.

Innovations in extension can be individual driven (Agri-Startups), Federation driven (MAHA Mango, MAHA Grapes etc.,), Cooperatives driven (IFFCO Foundation, NDDB etc.,), NGOs driven (MYRADA, BASIX, PRADAN etc.,), Government driven (CSC, RBK, Digital Platforms, Custom Hiring Centres for farm machinery including drones etc.,), and Private sector driven (proprietary technologies: hybrids/genetically modified crops; agro-chemicals; agricultural mechanization technologies). Problem based and technology driven extension (climate resilience, CFLD in pulses and oilseeds, raised bed sowing in soybean and chickpea, crop residue management etc.,) has been the focus of late.

It is the need of the hour to frame road map for improved policies, programmes and extension approaches to address issues for up-scaling and out-scaling of innovations and ultimately lead to personalized advisory platform related to inputs availability, knowledge and infrastructure support for commercial entities, cluster approach for precision, high-tech and smart farming, and enhancing income of the farmers.

7. INNOVATIVE AGRICULTURAL EXTENSION MODELS

Frontline extension system has been conceptualized and being implemented by ICAR since 1974 for effective dissemination and adoption of technology. Krishi Vigyan Kendras (KVKs) are playing a role as a grassroots level extension institution working as a lighthouse of Indian Agricultural Science and Technology, linking farmers and other stakeholders to the National Agricultural Research System (NARS). Over the years various innovative models of agriculture extension have evolved for different situations. An example of ICT based model of ICAR-IARI has already been discussed above.

Now a days many young professionals with different educational background and training in IT and management are forming Agri Startups. There is a need to develop models for bringing these in effective extension delivery. By 2047 extension may be an integrated model mainly driven by the private extension agencies. However, these alone will not drive the sustainable natural resource and integrated pest management. Front-line extension and field extension system along with NGOs will need to focus on sustainable natural resource management extension.

It is acknowledged globally that Public-private partnership can deliver extension services more effectively. A mechanism needs to be developed to decide who should provide what information and at what point. ***Rythu Bharosa Kendra*** is a good example of such convergence.

Rythu Bharosa Kendra (RBK) is a village level farmer facilitation centre, a digital and integrated model for knowledge and service delivery to the farmers towards sustainable agricultural development. These one-stop facilities provide support in storage of agricultural commodities; post-harvest facilities; and procurement of quality inputs, including seeds, planting materials, fingerlings; feed; agro chemicals etc. in partnership with private agencies under MoU. The kiosks help in e-crop booking and technical advice on agriculture practices with the help of Agriculture/ Horticulture Assistants attached to the Village Secretariats. This one-stop facility also is helping farmers get pre-tested certified pesticides, fertilizers and animal feed. RBKs also provide information, crop advisory, and assistance in the hiring of field vehicles and machinery/equipment at 611 YSR Custom Hiring Centers (CHC).

Farmers look for good quality inputs and appropriate technology. There are 154 Veterinary labs, Integrated Agri Labs and Aqua Labs at district, Taluka and Constituency level for quality testing. ICAR Institutes and State Agricultural

Universities (SAUs) are knowledge partners for technology backstopping. Artificial Intelligence and IoT based app is developed to monitor and store all the quality control data. Second pillar of RBK is quality services to the farmers which include e-crop booking, input subsidy, crop insurance, subsidized seed distribution, custom hiring centre, soil and seed testing, milk procurement, immunization of animals and bank correspondent services. These services are delivered through digital tools to ensure direct benefit transfer. Social audit is a unique feature of RBK that brings in transparency in the system. Capacity building interventions including Farmer Field Schools with technical collaboration with the SAU, DAATC, Agricultural Research Stations (ARS) and KVKs covering various topical issues including organic farming, Good Agricultural Practices (GAPs) are important components. Integrated call centre provides agro-advisory, whereas, Crop Diagnostic visits are performed at the farmers' fields. It also has a digital platform, RBK YouTube channel, and magazine for the farmers

IARI-Post Office Linkage Extension Model is developed for effective delivery of IARI technology to distant farmers. With the shifting emphasis of the Indian agriculture towards diversification, sustainability, efficiency and commercialization, and a widening ratio of extension workers to farmers in the country, alternative frontline extension approaches are needed to reach farmers in distant places with improved technologies to enhance farm productivity and income. Keeping in mind the above challenges, Indian Agricultural Research Institute (IARI), New Delhi designed an innovative extension model named **IARI-Post Office Linkage Extension Model.** Rural branches of post offices cater to 5-15 villages, and the branch post masters (BPM) are mostly farmers. The model is aimed at utilizing the strength of the vast network of postal department in technology dissemination to distantly located farmers through village post masters working as community-based change agents. Major activities as recognized by the post office personnel were timely delivery of the seed and package of practices posted by IARI to the farmers, regular discussion with the fellow farmers about the improved crop cultivation technologies and establishing the model demonstration plots. Training programmes are organised in collaboration with the KVKs to strengthen their capacity. The model was found effective for making improved agricultural technologies available in the rural areas in relatively lesser time and cost. Yield of major cereals, oilseeds and vegetables increased by 11-30%. Capacity building of village postmasters (knowledge gain 23-36%) has benefitted the farmers of the area.

Pusa mKRISHI, mobile based advisory model, was developed by IARI in collaboration with Innovation Lab, TCS, Mumbai under the NAIP project entitled;'

Enhancing adaptive capacity to climate change in vulnerable regions" in order to provide customized as well as weather based advisory to farmers. It was tested in three districts namely, Mewat (Haryana), Dhar (Madhya Pradesh) and Ganjam (Odisha). Dynamic two way communication system with integration of information of climate, farm characteristics and technology for content and advisory and an expert console to manage the information flow between the users and the subject matter specialists were its salient features.

Convergence-based extension & Climate smart village model was conceptualized keeping integration of technology with social dimensions in view, and established at 151 vulnerable districts in the country. Climate Resilient village is conceptualized as a village where all the villagers contribute to mitigate the impacts of climate change by adopting climate resilient technologies through measures for reducing greenhouse gas emissions, bringing positive behavioral change, and devising local solutions to reduce vulnerability towards climate change impacts, keeping in view the region's socio-economic, gender and bio physical constraints. It is built on the premise of community participation and stakeholders' convergence approach. Village level institutions viz. Village Climate Risk Management Committees (VCRMC), custom hiring centers, seed banks, were established.

IARI-Voluntary Organization Partnership Extension Model is another innovative outreach strategy adopted by the ICAR-IARI in collaboration with active Voluntary Organizations (VOs). IARI has partnership with 28 VOs spread across 14 states of India since 2010. The model was designed on the principles of sharing the strength of partners, IARI in technology, and the VO partners in robust network at the grassroots level.

E-Choupal model of was started nearly twenty years back by the ITC Limited for connecting information to the farmers and supply chain reorganization, where farmers were treated as micro-producers. It gradually evolved as serving consumption needs of the farmers, and strengthening agricultural extension services.. In its third phase, e-choupal model is promoting services and products considering farmers as micro-entrepreneurs. ITC Metamarkets for Advanced Agriculture & Rural Services (ITCMAARS) provides an eco-system through promotion of FPOs, artificial intelligence and machine learning driven personalized agro-advisory, providing quality inputs, facilitating planned harvesting based on weather forecasts, and procurement with transparency in pricing and convenience of farmgate pickup of produce. ITC is also establishing lighthouse farm at every FPO to showcase model demonstration farms. Presently they have promoted more than 200 FPOs and covering more than 2 lakh acres as demo farms . Phygital model of delivery

gives a good mix of both physical services and digital platforms for providing round the clock services to the farmers.

BKC Aggregators presents a commercial model of t private sector extension and knowledge dissemination without promoting any specific brand, product or service. It provides specific advisories to farmers through *Fasal Salah* App to help prevent the damage to their crops and increase crop yields.

BKC's unique innovation is an ICT tool which hand holds the farmer for entire duration of the crop cycle from 'pre-sowing' to 'post-harvest' on individual basisbased on the information about the name of crop and date of sowing, provided by the farmer on *Fasal Salah*. The variety cultivated by farmer on his soil is then tracked with some very accurate and granulated weather forecast making crop cultivation weather resilient. Real time advisory prescriptions reduce input costs and optimize use of water, prevent damage from pests and diseases; as metGIS foresees weather 10 days ahead and can predict accurately the likely incidence of pests and diseases, and prescribe preventive measures thereto. Using this technology one farmer having same crop but two different sowing dates or different varieties receives separate sets of advisories. This ICT mode cuts down the extension costs by 80% and provides advisories 24x7 The direct benefit transfer (), if supported by DKT (Direct Knowledge Transfer) could more than double the farmers income.

8. DESIRED CONVERGENCE AMONG THE STAKEHOLDERS

Efficiency of technology, resources and other business management models can only be maximized, if extension is given a proper place and is not considered as the last mile activity. The above discussion amply reveals that there are many "Innovative Agricultural Extension Models" in the country, developed by different sectors with different objectives, which are worth considering forscaling up and scaling out. Appropriate models need to be standardized from the existing ones for maximum efficiency and effectiveness.

India's agriculture extension system has traditionally been managed by the public sector and is manpower-based, However, over the last decade we are looking at digital extension system and many private partners have also been actively engaged.While the manpower-based extension has a strength of ensuring greater adoption through its personalized contacts, IT based systems has the power of rapid knowledge transfer and cost effective networking Manpower based extension system is required even though it is costly and suffering from the weakness of

not being real time. It is impossible to have large number of manpower for every village and every household. Therefore, real time transfer capacitated extension system with digital technology, is required. The digital technology with artificial intelligence and machine learning can support human-based promotion of farming technology and adoption.

There are more than 2000 public sector institutions like KVKs, ICAR institutes, state/central agricultural universities and state extension system, dealing with agricultural extension in the country. There are many programmes and plans at the district/block level such as a Comprehensive District Agricultural Plan infrastructure development under RKVY, a Strategic Research and Extension Plan under ATMA, a District Credit Plan of NABARD & bankers, a District Irrigation Plan and Watershed Development Plan of Ministry of Agriculture, a district level Krishi Vigyan Kendra of ICAR, etc. However, lack of convergence among them is a matter of concern and needs immediate attention. . Public extension system with its strengths in infrastructure, resources and mandated responsibilities can make space for partnership with multiple actors/sectors to support with policy framework, partnership mechanism, adequate funds and monitoring processes. For ensuring effective and efficient partnership at KVK level a policy guideline from ICAR will help in a big way. A liberal access of agricultural technologies from the public sector institutions like ICAR/SAUs to the private extension system to take them forward will be helpful in fostering partnership.

There are a large number of input agencies, including the corporate sector, Start Ups, NGOs, and Agri-Business Centres, who can play an important role in promoting Public-Private Partnership in both agriculture and associated enterprises. Collaborations can be developed to promote partnership between public and private extension service providersthrough simple to implement MOUs andclearly mandated responsibilities..

There are often some misgivings among the public and private extension functionaries. The public extension system views that the private extension is working only for profit, while the private system apprehends that the public institutions are too rigid for other players. Hence it is important for the public extension system to take a lead and create confidence in private extension service providers promoting a bottom-up approach in extension models. There are some good practices for public private partnership (PPP) which doesn't allow any top down approach and follow bottom up planning. In order to survive, bottom up models of PPP should be customized based on the relative competencies of the partners, local crops, potential crop for marketing, etc.

Implementation of PPP models often face the administrative and financial challenges as the guidelines are made for implementation of public programmes, which are not always suitable in PPP mode. MANAGE, Hyderabad had tried to implement a PPP model, known as the Hoshangabad Model, in 2002. In this model, the public agriculture department was advised to go for a joint account, but the department was unable to do so because of the strict prevailing bye-laws. Unless there is a joint account, the private is not going to invest their money. So, administrative and financial guidelines need to be customized to support the PPP models.

There are some low hanging fruits for the public extension system to enter into partnership with greater ease.. The Government of India has agri-clinic and agri-business centres scheme implemented for the past 20 years in which 82000 people have been trained and 36000 agricultural graduates have established their own enterprises. These qualified agricultural graduates living in villages are providing value added extension services to the farmers on day to day basis. Thus, integrating agri-clinics and agri-preneurs to public extension system can be a mutually beneficial and effective step. The second scope for partnership is with agri-input dealers who are primarily rural entrepreneurs and the main source of information and agri-advisory to farmers.. It is estimated that around 3 lakh input dealers are there in the country. The MANAGE, Hyderabad has taken up one year long innovative training programs for such dealers imparting essential knowledge of soil, water, pests and diseases, as well as business ethics and has trained 76000 input dealers, so far, while 20000 more are undergoing this diploma course. It also imparts refresher training to already trained input dealers, so as to expand their role as effective para-extension professionals. These trained input dealers form a valuable brigade of extension agents and must be integrated formally in the national extension system. Similarly, 2 lakh Common Service Centres (CSC) in the country established under the digital agriculture programme, which have necessaryIT infrastructure, and IT entrepreneurs living in the village., have the potential to be converted to 2 lakh extension delivery points to add value to the Indian agricultural extension system.

Learning from Government's two partially successful watershed projects implemented in the states of Karnataka and Maharashtra with an objective to bring convergence of different systems indicated that the limited operational flexibility provided down the line was a big constraint in operating effectively.. In Jammu & Kashmir (J&K) there is functional convergence at three levels. The first level of convergence is Scientific Advisory Committee (SAC) of the state agricultural universities comprising representatives from the universities, ICAR institutes, KVKs, district

level development departments of agriculture and allied fields, NABARD, farmers' groups, etc. The second level of convergence is Zonal Agricultural Research and Extension Advisory Committee (ZAREAC) at the zonal level which meets twice a year. Besides the state university officials, representatives of all line departments, industries, NABARD, KVK, ICAR institutes, Panchayati Raj Institutions (PRIs), women, etc. participate in this committee. The third level of convergence is the monthly interaction of Additional Chief Secretary/Principal Secretary Agriculture, Vice Chancellors of two state agricultural universities, Directors of ICAR institutes and representatives of KVK, NABARD, higher education department, forest department, tourism department, marketing department, etc. More recently, J&K government has approved Holistic Development of Agriculture and Allied Sectors, and in this KVK has been identified as convergence hub at district level for all extension and development activities.

Market should be an integral part of every extension model, if the farmers' current share in consumer rupee is to be enhanced from 23% to 40, 50 or 60%. In this direction, the Government of J&K has made very sincere efforts and signed marketing MoU with Go Air airline for daily transportation of high value low volume horticultural crops of the famers of the state at the cost of Rs. 29/kg for gainful sale in Indian markets like Pune, Bengaluru, Bombay, Hyderabad, etc. The Govt of J&K provides 25% subsidy on air transportation cost.

The first pre-requisite for convergence is the collection of schematic information from the Department of Agriculture and Farmers Welfare, the State Department of Agriculture and the district / block administration for a cluster of 100 or 150 villages of a taluka. It is essentially required as hardly 30-35% farmers are aware of all the activities of the public schemes and a whole lot of information is required by the small and marginal farmers, welfare section, etc. The second prerequisite for convergence could be the 'empowered farmers' groups'. They would be there to exert pressure on the supply side to do the best for the demand side. The third prerequisite would be that how best the extension network at the micro-level is techno-savy, ICT driven and is more and more linked to the R&D linkages and looking for partnerships. The fourth prerequisite is the prioritization of ongoing programmes and activities at the level of village clusters of a block, looking into the resources and manpower available in different sectors and then try to merge if it works. So, the Matrix Mode of Convergence detailing the schemes, their provisions, different beneficiaries' category, kind of production systems and the extent of combining the resources and manpower at operational level would be required.

The kind of feedback that is received from the farmers, functionaries and converging partners and the spirit of partners in working together are driven by the convergence. The feedback from the field should be processed and shared with research system, development departments, policy people, district administration and so on and so forth. When it comes to HRD part in convergence, all public sector extension institutions have equal and important role. The output of local level HRD organization should be input for a little higher level HRD organization to have a better interplay between HRD systems. And, the moment HRD systems start interplaying with input-output relationship, the convergence would be more effective. Convergence would be more effective if the successful experiments and learnings are ploughed back at the local level. For example, ICAR's NICRA project has a village level Climate Change Management Committee with very established relations with KVKs. The learning from this convergence should be ploughed back.

In case of a single enterprise, convergence is a little easy at the micro level. But if there are multiple enterprises, then a different kind of matrix would be required depending upon the requirements of different sectors. Piloting a convergence project quickly in one or two blocks as a model would be a prudent decision to see the kind of responses and feedback. Determining the actor who will lead the convergence is also an important aspect. Based on the strength of local extension agent, it could be the best KVK in one block, an NGO in another and the input support service provider in the third.

Operational flexibility for finance, management and operations is also must for effective convergence. So, clear cut instructions on how to converge and how not to converge are required. For example, the Govt. of Andhra Pradesh empowered Zila Parishad to reallocate funds from one head of account to other head of account within the total boundary of allocation. The convergence demands transfer of manpower from one department to others, transfer of finances from one to other and also the resources between the agriculture and horticulture and animal husbandry, depending upon what is predominant in that district. This kind of empowerment would be necessary for effective convergence.

Agricultural Technology Management Agency (ATMA) is supposed to prepare mapping of different extension agencies including NGOs for the district. It is important to have delivery area-wise mapping and signing of MOUs for effective partnership. Keeping in view a large number of Government and NGO based extension service providers in the district, ATMA would be a good platform for working together with flexibility and resource sharing.

The ATMA was a good convergence concept when it implemented Strategic Research and Extension Plan in a farming system mode, initially. But unfortunately, that is not happening now, because, regular staff is declining and provision of contractual services staff has been made. This programme needs a revisit, now. The first critical evaluation of agricultural extension reforms in India made by CGIAR-IFPRI in late 2000 found that the challenges of agricultural extension system persisted because ATMA was scaled up too quickly without any analysis or consideration of different capacities or ownership and resources available at the diverse states. So, what is required is the visionary leadership at every level, right from top to bottom, then only the desired convergence will happen. A point was made about developing proper guidelines for convergence.

The Rainfed Area Authority has tested two models on convergence module – one in Odisha and another in Rajasthan with focus on the neglected areas. Accordingly, a programme on diversifying upland paddy to income led and more resilient cropping systems was launched in Odisha. In Rajasthan, programme to develop a pasture land and promote integrated livestock management system with focus on small ruminants of migrant communities has been implemented. It was found that the focus was on convergence in both the modules. As a result, people's representative came forward and put in their money into the system. So leadership is needed not only at the top level but also at the micro level. How to train leaders at the local level is also an important aspect to be looked into while dealing with the issue of convergence.

Extension was started at the time of Green Revolution and major thrust was given to the technology. The country has witnessed many social as well as technological innovations since then. The thrust on technological innovations (genetically improved seed, fertiliser, pesticides, irrigation, etc.) was required. As a result, the public extension system was dominated by different kind of Subject Matter Specialists. The changed scenario now demands more competencies from the extension functionaries to undertake varied responsibilities like development of DPR as well as development of community organization at the level of FPOs/ FPCs. There are more than 500 bye-laws to govern a company, but to govern the FPOs/ FPCs, bye laws of Companies Acts and Cooperative Acts have been put together. In a major shift, along with the technological innovations, we are moving to social innovations and to climate related innovations. Keeping this shift into consideration to focus is also required on project formulation, development of FPOs/ FPCs/ community organization and ecosystem restoration.

The major thrust that is emerging in extension is how to make policy, how to improve capacity, how to improve the advisory services through participatory approaches using ICT, GIS and AI, market led extension, inclusion strategy, pedagogy, technical writing, monitoring and evaluation strategy, community based common resources management, micro-finance, community mobilization for ecosystem restoration, etc. So, all these social science issues are becoming very-very important but the extension manpower are not well versed with them.

The latest definition of Agricultural Extension has been given by the "Committee for Doubling Farmers' Income" constituted by the Govt of India as "Agricultural Extension is an empowering system of sharing information, knowledge, technology, skills, risk and farm management practices, across agricultural sub-sectors and along all aspects of the agricultural supply chains, so as to enable the farmers to realize higher net income from their enterprise on a sustainable basis".

The concept has changed from plough to harvest to plough to plate when we talk about the post-harvest and with this change in concept, the change in process has never been embedded in the total agricultural extension system. But that is the need of the time.

The KVKs are doing well, but can do even better by improving the capacity of SMSs and giving them more autonomy. It has to work intensively by having a bottom up approach.

The extension education students are mostly disconnected with field extension; hence internship of students at ATARI, KVK, MANAGE, NGOs would help them enormously. In the extension education department, students don't have much field experience. In today's context, mere production advice is insufficient, so ICT expertise be developed to cater to supply chains. The guidelines must be framed to operationalize farmer to farmer extension models.

Farmer training on Good Agricultural Practices (GAP) and export orientation is equally important in the present context. But is not getting due attention in the current extension programmes. After so much efforts made by the DAFW & ICAR, not much convergence is taking place between ATMA and KVK.

9. RECOMMENDATIONS

- Krishi Vigyan Kendra (KVK) is the principal cog between hub (research system) and spoke (field extension system of the state agriculture and allied departments). Therefore, KVKs need remodeling and strengthening by augmenting its staff

strength and physical and logistic facilities, including Agri Clinics, Processing units, Technology Incubation Centres, and following a Single Window Delivery methodology. Rythu Bharosa Kendra (RBK) the innovative extension model of state Government of Andhra Pradesh has the potential to be replicated across the country. Innovative extension models of ITC, BKC Aggregators can be integrated with public sector ICT based extension delivery platforms like Kisan Sarathi and others for customized agro-advisory for crop management, weather alerts and market intelligence for a wider application.

- For 'Scaling up' of technologies innovative extension models are needed, which are robust and responsive to the changing situations. Convergence and partnership-based extension models are required with necessary policy guidelines to utilize the strength of the private partners. Technology backstopping to be provided by the frontline extension system in these partnerships.

- Many extension models have emerged for convergence from different parts of the country, which are zone specific and also organization specific. scale up but also to improve upon them. There is a need to have a think tank on Extensionfor continuous evaluation and improvement of ideas, and scaling up of successful models at national level .

- Given that small and marginal farmers, cannot depend on a monocrop and need integrated farming systems, extension services may be converged on a single platform. As these services are the functions of many agencies in the public and private sector, there is a need to have both inter and intra-service provider convergence right from the source to delivery. A policy back-up is needed to popularize and spread such good practices.

- A shift from Increasing production to profitability is the key context of various innovative extension models. In the present context agriculture is being converted into agri-business. Agricultural extension needs more capabilities in the field of processing, value addition, branding, and marketing, thus shifting its focus from higher production to higher earning .

- The successful cases of Farmer Producer Organizations (FPOs) and Commodity Based Organizations (CBOs) need to be studied and mainstreamed. Jumping from one to another extension model isnot desirable. There is a need for long-term thinking and implementation of a robust extension model is required for a considerable period of time to learn its limitations and to overcome shortcomings, if any.

- The public extension system has been dominated by different Subject Matter Specialists (SMSs). The present changed scenario demands more competencies from the extension functionaries to undertake varied responsibilities like development of DPR as well as development of community organizations such as FPOs/ FPCs. Such competencies are required to be developed among the extension professionals.
- Digital extension, including artificial intelligence and machine learning based extension is at the stage of discussion and experimentation. Very few of these models are at the ground level. Research system should develop such new agricultural extension models specific to regions, situations and commodities. These models should also be available in the public domain for open access.
- There are thousands of Agricultural Start-Ups in the country. The public extension system should extend its support through a partnership during the first one or two years, which are very critical for any Agricultural Start-Up to establish its services and make money for survival. Some Agri Start-Ups can also provide total solutions to the stakeholders in establishing infrastructures and other business establishments.
- The successful extension models of commodity specific growers' associations in Maharashtra or AMUL in Gujarat need to be replicated on other states and for other commodity growers.
- Competencies of extension and advisory services in agro-ecological farming, organic farming, natural farming etc. is increasingly talked about. Extension professionals in the public extension systems also need to develope/ upgrade their competency to address the needs of the stakeholders in diagnostics, certification, and accreditation for the quality inputs and products.
- E-commerce based input delivery models are not in vogue at present, with some evidence in urban sector. Well established e-commerce platforms catering to the agricultural commodities, quality inputs etc. need to be developed connecting producers to the consumers directly and ensuring timely availability of quality inputs in agriculture.

REFERENCES

Babu S.C., Joshi P.K., Glendenning C.J., Kwadwo A.O., and Sulaiman R.V. 2013. "The State of Agricultural Extension Reforms in India: Strategic Priorities and Policy Options". Agricultural Economics Research Review 26 (2): 159-172.

Chander M. 2015. The Krishi Vigyan Kendras (KVKs) in India: The full potential yet to be unleashed! AESA Blog. 46, 10. Available at http://www.aesa-gfras.net/Resources/file/RS-eds-MC-20-April%202015.pdf

FAO 2011. Buenas prácticas en el manejo de extensión en América Central. Food and Agricultural Organization of the United Nations, Rome.

Feder G., Birner R., and Anderson J.R. 2011. The Private Sector's Role in Agricultural Extension Systems: Potential and Limitations. International Food Policy Research Institute (IFPRI), Washington, D. C., USA.

Ferroni M. and Zhou Y. 2011. Review of Agricultural Extension in India. Syngenta Foundation for Sustainable Agriculture. June 2011. Available at: http://www.syngentafoundation.org/__temp/FERRONI_ZHOU_REVIEW_INDIA_EXTENSION.pdf

Glendenning G. J. et al. 2010. Review of Agricultural Extension in India. Are Farmers' Information Needs Being Met? IFPRI Discussion Paper 01048. Eastern and Southern Africa Regional Office. Addis Ababa. Ethiopia.

Kaegi Stefanie. 2015. "The Experiences of India's Agricultural Extension System in Reaching a Large Number of Farmers with Rural Advisory Services". Background paper to the SDC face-to-face workshop Reaching the Millions! Hanoi, Vietnam. March 2015.

Mukherjee A. and Maity A. 2015. "Public–Private Partnership for Convergence of Extension Services in Indian Agriculture". Current Science, 109 (9):1557-63.

Singh, A.K. and Roy Burman R. 2019. Agricultural extension reforms and institutional innovations for inclusive outreach in India. Agricultural Extension Reforms in South Asia: Status, Challenges, and Policy Options (Eds.) Suresh Babu and P.K. Joshi. Academic Press. 2019, Pages 289-315.

Singh A.K. and Roy Burman R. (2020) Journey of Agricultural Extension: Institutional Innovations and Reforms in Agricultural Higher Education, Research and Extension in India (Ed.) Debabrata Dasgupta. AGROBIOS (India), Jodhpur. 2021

Singh K.M. 2015. A Note on Indian Agricultural System vis-a-vis ATMA Model. Munich Personal RePEc Archive (MPRA). Available at: https://mpra.ub.uni-muenchen.de/67134/1/MPRA_paper_67134.pdf

Singh K.M., Swanson B.E., and Meena M.S. 2013. Reforming India's Pluralistic Extension System: Some Policy Issues. Available at: http://dx.doi.org/10.2139/ssrn.2306980

Singh K. M. and Meena M. S. 2011. Agricultural Innovations in India-Experiences of ATMA Model. Available at: http://dx.doi.org/10.2139/ssrn.1989823

Swanson B.E. 2008. Global Review of Good Agricultural Extension and Advisory Service Practices. Research and Extension Division, FAO, Rome.

Wongtschowski M., Belt J., Heemskerk W. and Kahan D., 2013, The business of agricultural business services: working with smallholders in Africa. Food and Agricultural Organization of the United Nations, Rome.

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