Indian Journal of Agricultural Sciences **91** (5): 659–65, May 2021/Review Article
https://doi.org/10.56093/ijas.v91i5.112978

Research in agricultural extension: Review of its contribution and challenges

KUPPUSAMY PONNUSAMY[1]* and RABINDRA NATH PADARIA[2]

ICAR-National Dairy Research Institute, Karnal, Haryana 132 001, India

Received: 17 January 2020; Accepted: 18 February 2021

ABSTRACT

The contribution of agricultural extension in food, nutritional and livelihood security in India is well accepted but the significance of agricultural extension research has not got the recognition it deserves, from decision-makers of research and development organizations. The limitations often lie with extension researchers who do not make required efforts to exemplify the outcomes of the research through elaboration of research methodology and contextualization with changing agro-climatic and socio-economic scenarios in the country. The review of several documents during 1970-20 imply the need for rethinking and reorientation of focus and strategy in extension research and thereby bringing better utilization of valuable findings for policy advocacy as well as harnessing the potential human resources for the socio-economic upliftment of Indian farmers.

Keywords: Contribution, Extension research, Pluralism, Productivity enhancement, Reorientation

The role of agricultural extension in multi-fold increase in farm production in various crops and enterprises, cannot be undermined as it has given the shape, direction and intensity for technology dissemination, keeping in view the prevailing farm ecology, socio-economic status, infrastructure and policy support. The benefits accrued due to the extension interventions have been well documented, reviewed and recognized by researchers, policy makers and other stakeholders in various fora. However, when the intended targets are not achieved, a section of researchers squarely blame the failure of extension which could be partly due to their ignorance and pre-conceived mindset of overall understanding of the context in which the extension efforts are taken as well as unrealistic expectation on positive gains of the technology or innovation (Ponnusamy and Pachaiyappan 2018). This has been often echoed by extension researchers in several seminars/conferences. At the same time, it is also equally important to introspect by extension scientists themselves on update and refinement of their approaches and models in tune with emerging scenarios both in respect of technology and sociological perspectives. This paper primarily focuses on reorientation of focus and strategy for strengthening agricultural extension research in India.

Present address: [1]ICAR-National Dairy Research Institute, Karnal, Haryana; [2]ICAR-Indian Agricultural Research Institute, New Delhi. *Corresponding author e-mail: ponnusamyk@hotmail.com.

Contribution of extension to agricultural and national prosperity

Several factors have been documented for contributing to a significant increase in production of food grains, oilseeds, milk and eggs, which have also helped to reduce imports considerably. Among these, quality HYV seeds, fertilizer responsive varieties, investment in irrigation and storage infrastructure and institutional credit facilities are often said to have played a facilitating role (Working Group Report on Agricultural Extension in Haryana 2017). The contribution of extension approaches and methodologies has been equally considerable. The National Demonstration programme (1965) has led to phenomenal rise in acceptance of quality seeds thus contributing towards higher production. The average yield of rice under national demonstration programme was increased by a compound growth rate of 0.7%, while the area and production were increased by 3.3% and 2.5% respectively during 1965-66 and 1984-85. The area under wheat and production was increased by compound growth rate of 9.5% and 4.2%, respectively during the period. There was manifold increase in the average yields of paddy, wheat, maize, sorghum and pearl millet (Prasad *et al.* 1987) as evident from the data of general average and national demonstration average (Table 1) which indicate the possibility of doubling the productivity with provision of needed inputs, extension services and market.

The figures amply highlight that the approach of national demonstration had impact in translating the right technology in the fields, which must have been possible with change in knowledge, skill and attitude among farmers. Though the gains attained in different regions (Eastern, southern, western and northern) differed, but the average of 12 years showed

Table 1 Comparative study of general and National Demonstrations: Average of highest yields of major crops between 1971-72 and 1983-84 in (q/ha)

Crops	General average (q/ha)	Average of National Demonstrations (q/ha)	Average of highest yields of National Demonstrations (q/ha)
Paddy	18.23	50.99	115.17
Wheat	14.90	36.35	75.77
Maize	10.82	33.47	74.57
Sorghum	6.36	36.71	71.46
Pearl millet	4.58	25.62	47.80

that there was gain in crops including paddy, wheat, maize, sorghum, pearl millet, greengram and groundnut. However, what assumed significance was the potential of genetic vigour and input responsiveness of varieties. The extension skills and missionary approach failed to gain recognition. Very much streamlined extension machinery which always tried to synthesize efforts of all other factors was not given the due recognition it deserves; in achieving the desired outcome of the rainbow revolution. Table 2 highlights the role played by extension in the past and its expected role in future agricultural performance, as knowledge intensive farming only can enhance the prosperity of agriculture and its allied farm enterprises.

Estimation of the economic benefits of extension faces a number of difficulties, the most serious of which has been an inability to separate the effects of extension contributions to farm income from other sources, notably from research and human capital (Wossen *et al.* 2017, Cawley *et al.* 2018). By 2030 for meeting the 35 Mt requirement of pulses the existing (2017-18) productivity of 835 kg/ha shall have to be raised to 1030 kg/ha in addition to bringing additional coverage of pulses in an area of 5-6 Mha over the existing normal area. This can be possible through deployment of appropriate extension interventions.

Annals of agricultural extension

Confusion prevails among various agricultural and non-agricultural stakeholders about the actual role of agricultural extension especially in the arena of extension research in ICAR institutes, SAUs/SVUs/SFUs, KVKs and similar other organizations. Since these roles have not been explicitly expressed in terms of products, patents, publications and processes, visible benefits are often subdued and the interest among extension researchers tends to decline in due course of time. However, this scenario needs to be changed with proper sensitization of executives and policy makers. The extension researchers can contribute and demonstrate their core competencies in different facets of agricultural development. The role clarity of an extension specialist has to be understood and emphasized upon its vital and tangible utilities to the farmers and society. Following are the important spheres of influence of farm extension.

Table 2 Production gap in supply and expected demand of farm commodities (million tonnes)

Commodity	2017-18	2018-19	2025/2030
Cereals			
Paddy	114.00	115.60	156 (2030)
Wheat	97.11	99.12	114.6 (2025)
Maize	27.14	27.80	42.35 (2025)
Sorghum	-	7.29	9.83 (2030)
Pulses	23.95	24.02	30 (2030)
Oilseeds	-	66.80	102.30 (2030)
Potato		46.4	125 (2050)
Cotton (lakh bales)	370	361	-
Sugarcane (million tonnes)	352 (2015-16)	350	440
Animal products			
Milk	176.4	187.7	241(2025)
Meat	7.4	8.1	15 (2030)
Wool (Million kg)	43.5	40.4	57 (2025)
Egg (Billion)	88.1 (69 eggs/year/ person)	103.9	-
Fish	10.07	13.7	(2030)
Fertilizer (Lmt)	414.41	462.20	-
Horticulture crops	305.4	314.67	-

Source: www.agricoop.nic.in (2017-18 Annual Report); www.icar.org.in (VISION 2030); www.vetextension.com; www.dahd.nic.in (VISION 2022); https://iimr.icar.gov.in/ ; http://millets.res.in/ ; https://www.iivr.org.in/ ; https://icar.org.in/cari/ ; http://www.icar-iior.org.in/ ; https://sugarcane.icar.gov.in/index.php/en/ ; Cotton Advisory Board-Press release, 2018

Productivity enhancement

The productivity of most of the farm commodities is comparatively lesser than the potential yield in India and actual yield in agriculturally progressive nations (Table 3). Agricultural extension needs to play a pivotal role in yield enhancement of different farm commodities to meet the needs of the growing population. The purpose of extension is to enable farmers to seek and use desirable information for their betterment. Knowledge gaps contribute to yield gaps. Services and quality inputs are essential productivity-enhancing tools. However, their optimum use requires knowledge. Farmers also need information on prices and markets, post-harvest management, produce quality determinants, and safety standards (Ferroni and Zhou 2012). Table 3 highlights the yield realized by farmers as compared to potential yield of farm commodities in a particular agro-ecological region as well as yields realized by some of the progressive agricultural nations across the world. This clearly indicates the necessity of giving due importance to farm extension. Of late the extension reforms have made significant impact in enhancing the technology dissemination and micro-enterprise development (Sharma

Table 3 Yield Gap Analysis of different farm commodities

Commodity	Actual yield* (kg/ha)	Potential yield* (kg/ha)	Yield in progressive countries* (kg/ha)
Paddy	3848	9000	6909 (China)
Wheat	3219	7210	5481 (China)
Maize	3115	1600	6020 (China)
Sugarcane	69735	180,000	76096 (China)
Pulses	500-1000		>2000 (Canada and USA)
Chickpea	1435	2500-3000	
Pigeon pea	1500		
Oilseeds	1180	3750-4000	3000 (USA)
Groundnut			
Horticulture crops			
Apples	7426	40000-60000	18641 (China)
Grapes	21329	25000-30000	16904 (China)
Oranges	12724	40000-50000	22000-35000 (USA)
Potatoes	22306	40000-70000	17200 (China)
Milk			
Cross bred cow	7.42 kg/day	25 kg/day	32 kg/day (USA)
Indigenous buffalo	5.92 kg/day		
Meat			
Buffalo	138 kg/an	215 kg/ animal (Swamp buffalo)	100 kg/an (China)
Cattle	103 kg/an		144 kg/an(China)
Chicken	1.38 kg/an		1.37 kg/an (China)
Egg	88.14 billion		536 billion (China)
Indigenous duck	166.07/yr		
Improved duck	192.43/yr		
Campbell	250-300/yr		340/yr (USA)
Fish: Shrimp	1180 kg/ ha/yr	9000 kg/ ha/yr	7000 kg/ha/yr
Cotton	540 kg/ha	3500 kg/ha	1311 kg/ha (China)

*Data were compiled from various published sources

Source: FAOSTAT (2017) ; Cotton Advisory board; Agricultural Outlook Forum 2018; Dairy Outlook, USDA, Feb 2019; DADF, 2017; NFSM 2018 ; Oilseed; FLD Data, 2007-13, IIPR Kanpur ; Survey on apple production and variety identification in Chencha district of Ethiopia, Journal of Agriculture Food Technology, 2014.

2002). There has been increase in extension activities as well as inter-linkages among several line departments due to implementation of Agricultural Technology Management Agency (ATMA).

Income, employment and livelihood

The visible impact can be created by agricultural extension by enhancing income and employment opportunities and thereby contributing to better livelihoods of millions of farm households. KVKs and extension scientists working across research organisations could conduct Front Line Demonstrations (FLDs) and capacity building programs on these aspects. Analysis of MGNREGA revealed that wage increases are biased towards women and lead to higher rural labour force participation (Zimmermann 2013). MGNREGA led to a 9-13% reduction in child labour and broadened the choices and capabilities of women by improving their earnings thereby facilitating women empowerment (Dev 2011). It greatly improved financial access (Ghosh 2017). Extension can contribute in skill enhancement of this large chunk of labourers for ensuring their livelihood security. Farm schools for labourers could be a good initiative. Training for skill development among the labourers for System of Rice Intensification Technology by KVK, Barh in Bihar led to speedy diffusion and adoption of the technology.

Alleviation of poverty and malnutrition

In India, 21.9% of the population lives in extreme poverty and 15.2% of people are malnourished. Adult men (22.7%) and women (53%) of 15-49 years suffer from anemia in India. Women lack physical and financial access to nutritious food and knowledge about good nutrition. Investing in agricultural extension with focus on boosting the income of smallholder farmers, foresters, fisher folk, rural women and youth would promote inclusive and equitable growth while tackling the root causes of poverty and hunger. Poverty and hunger reduction crucially depend on the increased productivity and profitability of diverse smallholder farmers who form 81% of total farmers where successful delivery of agricultural extension plays a critical role (Glendenning *et al*. 2010). Eight MDGs and 17 SDGs always emphasized alleviation of poverty and malnutrition wherein agricultural extension could introduce appropriate interventions to promote income generating and nutrient centric agricultural innovations (Ponnusamy *et al.* 2017a, Ponnusamy and Devi 2017). Many government programmes are directly and indirectly focusing on addressing these issues of serious concern.

Generation of policy inputs by impact assessment

Numerous studies by researchers and students of extension discipline conducted across the different domains of agriculture can readily provide policy inputs for revitalizing the extension systems. Ponnusamy and Pachaiyappan (2018) stated that extension research was required to strengthen role and efficiencies of extension systems by generating policy inputs, models, mechanisms and approaches. In the absence of proper advice from the stakeholders, the recommendations made in the linear model of extension fail to attract their acceptance in totality. In this context, when the technological developments responding to unanticipated scenarios have to be founded on a holistic approach imbibing response of the client cultivators, the extension system has to shun piecemeal solutions and be

more participatory than ever before (Anderson *et al*. 2006, Ponnusamy *et al.* 2009). Extension personnel (both at the university and state level) need to take a lead in fostering collaboration and networking between and among different agencies simultaneously to suitably respond to the market-driven economy.

Sensitization of different stakeholders and technology dissemination

Non-extension scientists in private conversation often articulate poorly or inadvertently conceived methodological and applied nature of agricultural extension as a discipline. This needs to be shed-off. Prevailing perceptions among the fellow farm scientists in general and extension brethren in particular need to be spruced up in accordance with tremendous contribution of agricultural extension in terms of ensuring food and nutritional security, reduction of imbalances in reach of technologies and serving as a barometer of promotional efforts of different development agencies (Ponnusamy *et al.* 2019). For example, water being a precious commodity, extension can play a critical role in its proper utilization, augmentation and development through awareness creation, pilot testing and demonstration of new extension models and polarize the farming community towards enhancing the water use efficiency. Effective endeavours for climate change adaptation calls for stakeholders' engagement as well as interdisciplinary approach with prime focus on extension in order to enhance the adaptive capacity of farmers through behavioural change and institutional arrangements like custom hire services, village committees, collective action for natural resource management and blending of traditional wisdom and practices; besides technological interventions (Ponnusamy *et al.* 2009). ICAR's mega project entitled, "Natitional Innovations in Climate Resilient Agriculture" is an apt example.

Plummeting points of extension science in catering various sub-sections, viz. agriculture, veterinary, fisheries and home science

The subject matter of extension is chosen at the masters' level by the scholars, largely as a chance rather than by choice. Extension is the least preferred amongst the aspirants. Knowingly or unknowingly, this attitude gets reflected among the extensionists in all walks of their professional life. This stands same across the agricultural allied subjects, viz. Veterinary Science, Home Science and Fisheries. Universities invariably have their field level units, which quite often have extension and training as one of its major mandate. This part is usually handled by non-extension persona, and it is totally missing from the view points of the administrators that extension subject specialists can handle this paramount mandate, effectively. This complacency is a crucial hiccup, needing immediate attention. Addressing these critical points requires a forum level representation and policy intervention. But, the majority of extension bodies have shown primary interest only in organizing seminars and conferences rather than addressing these critical points. This has happened, because of lack of zealous pursuance by professional societies or administrative organizations of extension instead of one strong body, which can influence the top level administration. Although at ICAR level, extension has been put under one bracket, it is undisputable that the support rendered by a basic degree in agriculture in agricultural extension, veterinary science in veterinary extension and so on, might suffice better extension by the extension personnel.

Challenges before agricultural extension

Dismal approaches in extension researches-more towards applied than basic: Strong extension methodologies can strengthen the technology dissemination efficiency and productive capacity of farm enterprises. Isolated efforts in bringing dynamics on to the technology dissemination process are not properly documented and therefore, not available to extension practitioners which badly reflects on the image of the discipline. The readership of extension journals is also limited. Investment is required in basic extension research especially new dimensions of technology transfer, prediction and forecasting of farming scenario and useful indices for analysis of primary data. For generalization, there is a need to develop cross-sectional as well as time series data. There should be in-built mechanism in technology transfer process to maintain the data about the technological changes as well as changes at household levels in terms of resource base, adoption behvaiour, income and livelihoods over a period of time.

Perception of extension as a science, as an art and as a service: Missing demarcation bounds in these three aspects: Extension is a comprehensive discipline encompassing principles and theories of social and behavioural science, art of communication, science of prediction and analytics, and passion for community development or serving the poor through delivering need centric services. Although demarcation is there among these percepts, extension researchers need to develop innate capability in acquiring the skills of all the three domains. They should use these skills in a contextual manner considering needs, availability of resources, nature of audience, nature of interventions and expected outputs. Extension teaching is all about rendering knowledge of how to do extension which includes research and application too. Approaches vary in extension teaching in academia and to farm level beneficiaries (individual farmers, farm families, farmer societies, groups etc). Possessing expertise in only some of the selective methods of extension and compromising the holistic requirements often ends in ineffective communication. Here lies the need of distinct understanding of extension as an art, science and service.

Understanding of concepts and principles by extension professionals: It would not be an academic offence to put forth that many a times extension researchers themselves have a poor understanding of certain concepts, approaches and applicability of extension methodologies. Inappropriate

practices too have legacy and often wrong methodological applications are carried forward in postgraduate thesis works. The postgraduate students who come to start their academic career need to be provided with constructive guidance about the identification, operational definition and appropriate measurement of constructs besides understanding of importance of theoretical/conceptual framework for any research study. Very often same sets of variables are selected for any kind of study without any logical thought or theoretical support. They often say; it is an "Old wine in a new bottle" without deeply studying the concepts and new programmes (Ponnusamy 2014). While using Likert scale for capturing the varying levels of perceptions and attitudes, the researchers fail to explain the rationale of 3/5/7/9/11 point-continuum when questioned upon the logic and utility of such classification. The crises besetting extension discipline are integrally linked to and are symptoms of a deeper malaise embedded in the way it is practised. Dealing with each crisis, as if it were a singular phenomenon occurring in a single domain, will not work. It is linked through feedback loops, to multiple domains.

Further, outputs from a majority of diffusion studies could not provide a clue for further direction and rectification of identified deficiencies or gaps (Ponnusamy *et al.* 2017b). The outputs from these studies are mostly published in academic journals or presented in professional societies without reaching the actual end users (Prasad 2014). It is widely felt that social science capacity in terms of number, quality, consistence, coherence, productivity, relevance, and linkages with ARIs and development agencies, NGOs, FOs, farmers in the NARS (National Agricultural Research System), is not only low but also decreasing. It is a concern which is often more expressed and sympathized than analyzed and redressed (Mruthyunjaya 2014).

Pitfalls in teaching: The extension subject is taught in various agricultural, veterinary and fishery colleges, however, with inadequate faculty strength and sometimes by non-extension professionals. Consequently, students are very often subjected to undertake repetitive research. Even if sufficient faculty members are available, there are issues of concern related to relevance of course content, treatment and delivery of content, teaching styles, using downloaded power point presentations which have no context to the subject being taught. Faculty seldom updates their knowledge and skill due to lack of congenial environment or existing high level of demotivation. Field exposure of students is a rare event. Even if so, they are accompanied by contractual staff who have no extension background. Use of extension mix or teaching mix has almost been stopped with major focus on rote learning. The extension research is mostly handled by ICAR and SAUs/SVUs. Most of the studies relate to ex-post facto research (NAAS 2017), undertaken by post-graduate students at micro level using smaller sample size with limited funding. This could not generate adequate inputs for generalization and extrapolation, leading to rare utilization of research findings for policy making.

Encroachment of other disciplines: Since extension researchers fail to highlight the salient outputs of their work as policy inputs or learning improvement points, other discipline researchers exhibit keen interest in the extension work. Although, this is a welcome approach, this often puts extension scientists in poor light and creates a distorted perception among higher officials. It further leads to discouragement and demotivation. While other discipline scientists can apply for Director of Extension in farm universities or Director of ATARI, extension scientists do not foresee such opportunities for themselves in crop and animal based institutes. Further, an aggressive marketing of the discipline of extension is needed, especially in the context of other disciplines competing for many jobs in the areas of rural development, where extension had a monopoly in the past (Prasad 2001).

Anomalies in professional ethics: A visible and valiant outcome of extension research is possible, if the ethics in planning to reporting is followed. For example, adoption and communication behaviour studies are repeated even in the same study area, species and sometimes same target groups. There is lack of proper check-up and monitoring. Rather than the area of specialization, convenience is often the criteria for selection of external examiners for thesis evaluation Emphasis upon quantity of publications has forced postgraduate students and young professionals to fall in trap of predatory and spurious journals, which accept papers without peer review. It is silently destroying the science communication abilities among the young professionals. Sometimes good work is discouraged due to lack of professional ethics.

Balancing public (farmers) and controlling officers: It is often said that a worthy technology would automatically get disseminated through mouth to mouth communication. When there are hurdles in dissemination of technology, extension agents push it through several techniques. Even then, the rate of adoption is not impressive due to interplay of several bio-physical and socio-economic factors. The extension agents under these circumstances have to convince the farmers as well as provide a rosy picture about the impact of technology adoption to the controlling officers. This mismatch is reflected in the name of targets and achievements which are set, ignoring field realities in a top down decision making approach. So, are we really moving in the right path? The essence of extension philosophy does need to prevail for development and dissemination of appropriate technologies through refinement based upon feedback. Farmer-back to- farmer model needs to be practised. Demand for client centric utility oriented extension must be recognized.

Demotivation and pessimism among extension researchers: Among the various scientists working in NARS, extension scientists get demotivated due to absence of conducive working conditions. This includes unwanted criticism, executing miscellaneous tasks which may not yield any scoring points, the nature of work reflecting like social work which may not bring patents, high rated publications, awards, recognitions; and bestowing extension responsibilities to non-extension specialists by higher-ups.

On one hand this leads to demotivation and on the other hand builds up pessimism over the essential tasks in the domain of extension education. Pessimism would lead to a total collapse of work culture. This will severely hamper the work productivity of extension scientists and overall organizational productivity. The scientific morale will be lost and set a bad precedent for youngsters who aspire to enter the extension domain with a lot of hope and opportunities.

Forced to focus on unproductive extension methods: The top-down approach in allocation of work, limited resources, work pressure and limited participation of co-workers often force the project leaders to experiment their ideas with routine extension methods and prohibits them to try new extension methods as they have to grapple with several rules and regulations of the government organizations. Ideally, one has to work with innovative methods.

As a subject matter, why is extension always an alternatively preferred one?

Extension is often chosen as a matter of chance rather than a choice. The students try out all other options and prefer to come after exhausting other lucrative choices. This indicates serious lacuna in projection of actual contribution of extension as an academic discipline. There is no contradiction in practising extension as a service function by farm professionals for dissemination of technologies, models and processes. Major problem lies in projection of core competencies which can attract the students and other stakeholders to extension as a discipline. The scenario could be changed with attractive, relevant and gratifying curriculum. Practical curricula in extension are a matter of concern. There is lack of focus on definite activities for practical of many courses.

Expectation of stakeholders from extension researchers

Ponnusamy and Pachaiyappan (2018) brought out the expectations of different stakeholders from extension scientists who are involved in promotion of scientific farming in India. The Directors of ICAR institutes and Vice-Chancellors of farm universities expect the extension scientists to develop extension models for faster dissemination of technologies and upscaling of innovations. Policy makers and planners desire the assessment of factors favouring productivity and profitability; reasons of agrarian distress and models for income enhancement. Field extension functionaries expect new models of technology dissemination; handling of advanced tools and techniques as well as effective solutions to critical issues of farming. Farmers exhibit keen interest on free inputs, advisory services and enabling mechanisms to realize higher incomes in their farms. Students and fellow researchers want advanced methodologies and analytical techniques in extension. Input dealers and educated public expect trends, mindsets and future of farming for better planning. Therefore, it is a herculean challenge to satisfy the wide-ranging expectations of different stakeholders by the extension scientists.

Thrust areas of extension research

The base paper for the brainstorming session on "Strengthening Agricultural Extension Research and Education" conducted by National Academy of Agricultural Sciences (NAAS) on 09.07.2016 at New Delhi identified the specific thrust areas of research in extension; Mapping of socio-economic and socio-personal patterns of farming communities in different agro-ecosystems; Climate change adaptation: typology, frameworks, policy and practice dimensions; Process on co-production of adaptive knowledge and co-management with multi-stakeholders; Citizen science, agricultural sustainability and agricultural policies: livelihood implications (with regional and national priority); Trans disciplinary research in agricultural sector for plural knowledge; Institutional innovations, extension reforms, dynamics of convergence and linkages in extension; Skill gap analysis and capacity development of stakeholders; ICT-led knowledge management, usage patterns and impact; Nutrition extension: awareness, dietary pattern, designing suitable interventions for nutri-smart villages; Value chain analysis, market-led extension and agri-business model; Technology and resource mapping for optimized use and suitable extension interventions; New approaches and process of extension interventions, and social learning for climate smart agriculture; Adoption and impact assessment of NARS technologies; Nutrition security at household and individual level should be one of the major objectives of agriculture extension research and needs to be incorporated in extension curriculum; Gender partnership in agriculture and gender sensitization.

Therefore, it is highly important to sensitize the extension scientists and policy makers through research studies, discussions, debates and policy briefs. for orienting them to undertake research in the emerging areas of scientific farming where they will be considered as vital stakeholders.

Equipping agricultural extension with empowerment dimensions

Following strategies are suggested for strengthening extension research in the country;

Fine tuning of syllabus at Masters and Ph D level keeping in view the emerging researchable issues; Capacity building of extension faculty members on new core competencies; Carving exclusive domain activities for extension scientists to maintain the individuality of the discipline; Sensitization of policy makers and planners on role and importance of extension research Incentivizing extension researchers for their performance; Allocation of domain specific tasks to only extension specialists; Building of strong networks on extension research on the line of IFPRI; Capturing every task performed by extension scientists with relevant scoring points for promotion; Man power planning of extension personnel for multifarious sub-genres.

Policy decisions

All India Coordinated Research Project in Extension must be started in order to facilitate meta analyzed data

and derive useful policy guidelines. Initiatives of Division of Agricultural Extension, ICAR like extra-mural research projects, Farmer FIRST, ARYA and NEMA (New Extension Methodologies and Approaches) and capacity building of extension professionals through international organizations made substantial impact in sensitizing and upscaling of research competencies of extension professionals; Network projects need to be started on the basis of issues and approaches in the discipline of extension education; Identification of domain role for KVK extension scientists to conduct FLD; Research institutions should earmark at least 10% of its budget for testing new extension models and promoting sustainable livelihood through integrated approach without much botheration about institute specific mandate; When extension scientists are available in a particular institution, the responsibility can be bestowed on them to manage KVK, ATIC, BPD and ToT units in order to harness their true potential.

Conclusion

Extension system is still evolving with ongoing changes and challenges which it faces amidst its enduring societal services. While earlier, extension specialists blamed the external factors for the decline of discipline, now there is an increasing realization that extension researchers need to introspect their current working mode and strategies being adopted in the technology dissemination process as well as community mobilization and engagement. Extension as a discipline should lay strong emphasis upon research designs as well as quantitative and qualitative techniques to address the burning issues affecting livelihood of farm families such as poverty, malnutrition, unemployment, climate change and gender discrimination. This can be achieved by developing extension methodologies and models involving issue based farmer centric interventions, appropriate mix of extension methods and networking with all vital stakeholders. A collective strategy is the need of the hour to build relevant syllabus, approaches and methodologies so that future extensionists will acquire demand driven core competencies.

REFERENCES

Anderson J R, Gershon F and Ganguly S. 2006. The rise and fall of training and visit extension: An Asian mini-drama with an African epilogue. World Bank Policy Research Working Paper 3928. Agriculture and Rural Development Department, World Bank, Washington, DC, USA 30 p.

Cawley A, O'Donoghue C, Heanue K, Hilliard R and Sheehan M. 2018. The impact of extension services on farm level income: An instrumental variable approach to combat Eendogeneity. *Applied Economic Perspectives and Policy* **40**(4): 585-612.

Dev S M. 2011. NREGA and Child well being. Institute for Human Development (IHD)-UNICEF working paper No. 10. Institute for Human Development, New Delhi.

Ferroni M and Zhou Y. 2012. Achievements and challenges in agricultural extension in India. *Global Journal of Emerging Market Economies* **4**(3): 319–46.

Ghosh S. 2017. Did MGNREGS improve Financial Inclusion?. *Economic and Political Weekly*. **LII** (12): 106-14.

Glendenning C J, Babu S and Asenso-Okyere K. 2010. Review of agricultural extension in India—Are farmers' information needs being met? *IFPRI Discussion Paper* 01048.

Mruthyunjaya. 2014. Status and strategies for strengthening of Agricultural Economics Research and Education in National Agricultural Research System of India. Presidential address during 22nd Annual Conference of Agricultural Economics Research Association (India) held at UAS, Raichur, Karnataka during 18-20 November 2014. pp 1-36.

NAAS. 2017. Strengthening Agricultural Extension Research and Education-The Way Forward. Strategy Paper No. 5. National Academy of Agricultural Sciences, New Delhi, pp 12.

Ponnusamy K, Gupta J and Nagarajan R. 2009. Indigenous Technical Knowledge (ITK) in dairy enterprise in coastal Tamil Nadu. *Indian Journal of Traditional Knowledge* **8** (2): 206-211.

Ponnusamy K 2014. Agricultural Extension: Some misconceptions and missed opportunities. *Agricultural Extension Review* **26**: 12-16.

Ponnusamy K, Binoo P Bonny and Manju Dutta Das. 2017a. Impact of public private partnership model on women empowerment in agriculture. *Indian Journal of Agricultural Sciences* **87**(5): 613–17.

Ponnusamy K, Chauhan A K and Meena S. 2017b. Testing the effectiveness of Pasu Sakhi: An innovation for resource poor farm women in Rajasthan. *Indian Journal of Animal Sciences* **87**(2): 229–33.

Ponnusamy K and Pachaiyappan K. 2018. Strengthening extension research in animal husbandry: review of issues and strategies. *Indian Journal of Animal Sciences* **88**(2): 137–43.

Ponnusamy K, Chakravarty R and Singh S. 2019. Extension interventions in coping of farmers against effect of climate change in dairy farming. *Indian Journal of Dairy Science*. **72** (4): 430-36.

Ponnusamy K and Devi M K. 2017. Impact of integrated farming system approach on doubling farmers' income. *Agricultural Economics Research Review* **30**: 233-40.

Prasad C, Choudhary B N and Nayar B B.1987. First-line Transfer of Technology Projects. Publication and Information Division, ICAR, New Delhi.

Prasad R M. 2001. Paradigm shift in the role of agricultural extension in SAUs: An introspection. Conference proceedings of lead papers and abstracts, National seminar on extension role of agricultural universities in India, 72.

Prasad M. 2014. Extension Research: Random Thoughts From a Well-Wisher. AESA Blog 39: Available in http:/aesa-gfras.net/Resources/file/Prasad%20Sir-%20Blog%20 39-Final.pdf.

Sharma R. 2002. Reforms in agricultural extension: New policy framework. *Economic and Political Weekly* **37**(30): 3124-31.

Working Group Report on Agricultural Extension In Haryana, 2017. *Haryana Kisan Ayog*, Government of Haryana.

Wossen T, Abdoulaye T, Alene A, Haile M G, Feleke S, Olanrewaju A and Manyong V. 2017. Impacts of extension access and cooperative membership on technology adoption and household welfare. *Journal of Rural Studies* **54**: 223–33.

Zimmerman L. 2013. Why Guarantee Employment?.Evidence from a Large Public Works Programme. MGNREGS: Taking Stock and Looking Ahead. Proceedings of an international conference on MGNREGS, 26-28 March, Mumbai, IGIDR.