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Performance appraisal of the Frontline Extension System in north eastern region of India: A policy imperative

S PAUL[1], A K TRIPATHI[2], R R BURMAN[3] and A K SINGH[4]

ICAR–Agricultural Technology Application Research Institute, Umiam, Meghalaya

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ABSTRACT

The difficulty prone and disadvantageous areas of the country, generally being untouched and unreached in terms of efficient execution of agricultural development programmes and policy measures, the frontline extension set-up is expected to be effective enough to voice and take over development issues of the inhabitant peasants. Concurrent to the concern, the present study aimed at a functionary level performance appraisal of the frontline extension system in north eastern region of India with a sample size of 231 Subject Matter Specialists (SMSs) from 59 Krishi Vigyan Kendras (KVKs) across the eight north eastern states. A principal component analysis based Composite Job Performance Index (CJPI) was developed to measure performance of the respondent SMSs in different job areas. The study revealed that the human resource development and organizational development intervention for harnessing optimum performance of the SMSs require immediate emphasis. The overall performance in the area of field crop production and improvement was the best among the seven thrust areas identified under the study, although performance in extension and communication modelling generated real concern as per the CJPI. A regression analysis depicted that gender, physical facilities, support and professional mentorship received from the host institute, and participation in knowledge sharing forums had significant association with job performance. Timely and adequately funding the KVKs for infrastructure development is crucial along with wilful self-updating and self-development on the part of the functionaries for harnessing optimum individual performance and thereby overall functioning of the frontline extension system.

Key words: Disadvantageous area, Frontline extension, North east, Performance appraisal, Principal component analysis

Poverty, hunger and associated problems are prevalent in a larger scale in disadvantageous regions like north eastern part of India where the economy continues to be at the backward enclave, anchored in majority by income from farming, albeit farming is hardly considered as a profitable business venture, carried out mostly for subsistence and constrained by several factors beyond human control. In the region, frontline extension system in general and Krishi Vigyan Kendras (KVKs) in particular therefore continues to be the key machinery to bring technological products and services to the farmers' doorsteps. The Kendras, in fact play the pivotal role in the public agricultural extension system by attempting to bridge the gap between technology generation in laboratories and its adoption in the farmers' fields through a well-defined mechanism of technology evaluation, demonstration, capacity building of stakeholders, group and mass mobilization and distribution of critical inputs to the farmers. In north east region, there is at present a network of 78 KVKs, spreading across the eight north eastern states, Arunachal Pradesh (14), Asom (25), Manipur (9), Meghalaya (5), Mizoram (8), Nagaland (9), Sikkim (4) and Tripura (4) (ICAR- ATARI, Zone-III Annual Report 2015). Amidst hardships faced in the region, the Subject Matter Specialists (SMSs) working in different KVKs of the region undertake different activities in line with the KVK mandate of 'Technology Assessment and Demonstration for Application and Capacity Development.'

As the debate over effectiveness of the public funded institution based agricultural extension systems worldwide intensified, review and appraisal of its functioning had been felt increasingly essential throughout the globe. Organizational issues including lack of qualified, skilled and trained manpower as suitable for rural advisory services (Kaegi 2015), inadequacy of staff, lack of partnership and continued linear top-down focus hindering effectiveness and efficiency of public extension systems (Hulme 1983, Babu *et al.* 2013) have been pointed out.Operational and financial problems associated with public extension services have been recognized (Rivera *et al.* 2001, Alex *et al.* 2002),

[1] Scientist (e mail:sudiptaiari@gmail.com), [3]Principal Scientist, Division of Agricultural Extension, ICAR-IARI, New Delhi 110 012. [2]Head, Division of Social Science, ICAR Research Complex for NEH Region,Umiam, Meghalaya 793 103. [4]Deputy Director General (Agricultural Extension), ICAR, New Delhi 110 012.

albeit the crucial need for a critical government role and policy reforms in a pluralistic extension system to provide appropriate regulatory framework in order to ensure fair competition and maintain quality standards have also been reported (Umali-Delnlnger 1997, Singh *et al.* 2013). Functional issues including poor funding of the public agricultural extension system in India since the last few decades has also raised questions regarding the sustainability of its operation (Sulaiman and Van den ban 2000, Ferroni and Zhou 2011). Given the context, the starred question that has cropped up time and again is that whether the established mechanism of technology transfer of the frontline extension system in the north eastern region through Krishi Vigyan Kendras (KVKs) are over ridden with disproportionate rate of return to the investment, as it involves manpower and infrastructure development and recurring cost of maintenance. The major agricultural development parameters in the region did not produce a picture of significant positive change over the years. The relatively important responsibility of the frontline extension system to reach to the unreached can never be ignored, although the ethnographical, linguistic and cultural barriers and general apathy of the inhabitant farmers in the region in acceptance of the 'alien' extension agencies is difficult to overlook. The overall agricultural development in the region will result from increase in rate of adoption of improved technologies which in turn will depend upon increased efficiency in application of those technologies by the frontline extension system to the farmers' fields for wider diffusion. The overall impact of the frontline extension system in the region, therefore, largely depends upon effectiveness of the KVKs in general and the constituent functionaries in particular. In an effort to suggest suitable measures to bring into effect optimum performance of the KVKs, the present study undertakes functionary level performance appraisal and aims at finding out the correlates of performance in a policy perspective.

MATERIALS AND METHODS

The present study was conducted during 2012-13 to 2014-15 in all the eight north eastern states – Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. All the seventy four districts across eight states in the region in which Krishi Vigyan Kendras (KVKs) already existed at start of the project were included in the sampling frame. The Subject Matter Specialists (SMSs) of KVKs were considered as the units of measurement, hence were identified as the sample of respondents after a stratified random sampling. It should be noted here that the only SMSs undertaking mandated KVK activities at least for the preceding three years, were included in the sampling frame. A structured pretested questionnaire was mailed to all the KVKs to be responded by the SMSs and upon return of filled up questionnaires, they were screened for completeness in responses. In the process, a total of 231 SMSs (n=231) representing 59 districts/ KVKs in the region were finally selected for the purpose of the present study.

An *ex-post facto* research design was incorporated in the present study. In the context of a social research and *ex-post facto* design seeks to reveal possible relationships by observing an existing condition or state of affairs and searching back in time for plausible contributing factors (Kerlinger and Rint 1986). A composite job performance index (CJPI) was developed to measure job performance of individual SMSs of the KVKs under study. The CJPI consisted of six quantifiable indicators, carefully selected in line of the mandated activities performed by the KVKs: (i) participatory technology evaluation, (ii) participatory technology showcasing, (iii) entrepreneurial skill enhancement, (iv) extension programmes, (v) scientific productivity and (vi) mass outreach.

Following Feroze and Chauhan (2010), a two step methodology was adopted to construct the CJPI which necessarily involved first to eliminate bias of scale in the selected indicators and secondly a principal component analysis based assignment of weights to the indicators. A stratification of CJPIs using cumulative cube root frequency method helped in differentiating the high performer SMSs from the low performer ones. Descriptive statistical tools like frequency, percentage, arithmetic mean and standard deviation and inferential statistical tools like Duncan's Multiple Range Test (DMRT), correlation and regression were used in data analysis and interpretation. This has to be mentioned here that the independent variables (socio-personal, psychological, organizational, environmental and others) used in the regression model were carefully selected after literature search and thorough consultation with experts. Suitable measurement techniques, like chronology, absolute number, 5-point continuum, principal component analysis method as applicable to the individual independent variables were aptly used to quantify those variables. The statistical analysis software namely, SPSS (ver. 16.0) was used in analysis of data.

RESULTS AND DISCUSSION

Krishi Vigyan Kendras in the north eastern region during the three years under investigation (2012-13, 2013-14 and 2014-15) had intervened into different thrust areas- field crop production and improvement, home education and development, horticultural development, livestock and fisheries development, extension and communication modelling and natural resource management. The SMSs working under the different thrust areas as mentioned had differential level of performance and not all the thrust areas had equal proportion of high performers. There were different correlates of performance of different significance in locale of the study. The findings of the study are presented and thoroughly discussed below.

Performance and its variation under different thrust areas

As depicted by the mean CJPI scores, composite performance was the best in the area of field crop production and improvement (0.19) followed by crop protection (0.18), albeit extension and communication modelling requires further emphasis as indicated by the lower average CJPI

Table 1 Mean composite job performance scores of SMSs and their variation under different thrust areas

Thrust area	Sample size (n)	Mean CJPI	Standard deviation
Field crop production and improvement	41	0.19	0.07
Crop protection	31	0.18	0.06
Natural Resource Management	33	0.17	0.06
Horticultural development	41	0.17	0.05
Livestock and fisheries development	43	0.17	0.06
Home education and development	20	0.17	0.05
Extension and communication modelling	22	0.13	0.07
Total	231	0.17	0.06

Source: Authors' calculation.

score (0.13) (Table 1). Performance in the areas of natural resource management (0.17), horticultural development (0.17), livestock and fisheries development (0.17), and home education and development (0.17) was found more or less at the same level. A Duncan's Multiple Range Test (DMRT) confirmed that the CJPI scores in field crop production and improvement, crop protection, natural resource management, horticultural development, livestock and fisheries development and home education and development did not vary significantly, although the same score calculated for extension and communication modelling had a statistically reliable difference when compared to the other thrust areas (Table 2). As opined by the respondents under study, as like the other thrust areas, the specific thrust area of extension and communication modelling did not have physical outputs like technologies from research. The SMSs working under the thrust area of extension and communication modelling, hence were hardly involved in participatory technology evaluation through the established mechanism of on-farm testing of released technologies. Participatory technology evaluation being one of the important indicators of composite job performance index (CJPI), the SMSs working towards extension and communication modelling thus were not able to secure overall CJPI as compared to the other thrust areas.

Table 2 Post-hoc comparison of mean composite job performance scores of SMSs under different thrust areas

Test name	Thrust area	n	Subset for alpha (= 0.05) 1	2
Duncan's Multiple Range Test (DMRT)	Extension and communication modelling		22	0.13
	Natural Resource Management	33		0.17
	Livestock and fisheries development	43		0.17
	Horticultural development	41		0.17
	Home education and development	20		0.17
	Crop protection	31		0.18
	Field crop production and improvement	41		0.19
Significant at (p)			1.00	0.21

Source: Authors' calculation.

Distribution of SMSs according to the extent of scope of improvement in performance

The SMSs involved in assessment, refinement, capacity building and different extension activities under different thrust areas as mentioned above had varying degrees of performance as depicted by their CJPI scores. A cumulative cube root frequency analysis helped in discriminating the high performers from the low performers, and thereby helped in understanding the extent of immediate scope for improvement. The proportion of SMSs across thrust areas, having high to very high level of performance varied in range of 9-34; that of medium performers ranged between 22 and 44% but it is quite important to note that as high as 40-68% of the SMSs require attention and there remains immense scope to increase the level of their performance (Table 3).

Among the thrust areas towards which the SMSs had been working, 'field crop production and improvement' had the highest proportion (34.15%) of high performers, wherein 'extension and communication modelling' had the lowest proportion (9.09%) of the same. Again, the specific thrust area of 'extension and communication modelling' requires attention in the sense that the highest proportion (68.18%) of SMSs had immense scope to improve their performance. Coupled with the finding that 'extension and communication modelling' had the lowest average CJPI, the above finding

Table 3 Categorization and distribution of SMSs according to the scope of improvement in performance (n=231)

Thrust area	Scope for improving performance		
	Higher (0.00-0.15)	Medium (0.15-0.21)	Lesser (0.21-0.28)
Field crop production and improvement	18(43.90)	9(21.95)	14(34.15)
Crop protection	13(41.94)	13(41.94)	5(16.12)
Natural Resource Management	17(51.52)	11(33.33)	5(15.15)
Horticultural development	17(41.46)	18(43.90)	6(14.64)
Livestock and fisheries development	22(51.16)	15(34.88)	6(13.96)
Home education and development	8(40.00)	8(40.00)	4(20.00)
Extension and communication modelling	15(68.18)	5(22.73)	2(9.09)
Total (n=231)	110(47.62)	79(34.20)	42(18.18)

Data in parenthesis represent percentage. (Source: Authors' calculation).

clearly indicates that finding out, streamlining and improvising location specific extension and communication models through the prescribed methodology of KVK functioning in north eastern region requires further care and added thrust. As mentioned earlier also, the CJPI consisted of different parameters amongst which 'participatory technology evaluation' scored through conduct of on-farm testing and frontline demonstration, was an important one. Conducting on-farm testing and frontline demonstrations in the disciplines of Agricultural Extension and Agricultural Economics lacked clarity and did not have an established protocol, hence was difficult to undertake unlike other disciplines which had field oriented technologies to be evaluated. Thus the SMSs in the specific area as mentioned were unable to secure some score under the said parameter which affected their overall scoring.

The north eastern peasants generally use less of external farm inputs including chemical fertilizers and plant protection chemicals. Use of chemical fertilizers in the region is far below the national average (GOI 2013).The region is bestowed with enormous amount of natural resources; scientific use and recycling of which will determine sustainability of agricultural production in the region in the coming days, especially in the backdrop of climate change. Ecology of the region is fragile which makes it much more vulnerable to the climate change impacts, hence necessitates faster diffusion of natural resource management technologies related to conservation agriculture, afforestation, rain water harvesting and efficient use of farm inputs to mitigate the negative consequences of climate change in the region (Das *et al.* 2009). The situation demands superior level of performance of SMSs working towards this particular direction. Among the SMSs working towards increased adoption and capacity building of farmers for efficient management of natural resources, performance of a majority (51.52%) should therefore, be immediately strived for enhancement with requisite human resource development and proper organizational development interventions, as their performance was not up to the expected level. Even, one third (33.33%) of the SMSs produced medium level of performance, and only 15.15 % of the SMSs working towards natural resource management had higher level of performance. In crop protection also, the possibility to increase performance with proper interventions is suggested for 83.88 % of the SMSs.

Livestock and fisheries development for increased domestic availability of livestock and fish products is inevitable as far as food and nutritional security in the region is concerned. Food habit of all the tribes and most of the non-tribal population is predominantly non-vegetarian. In fact, fish and meat including chicken, beef and pork contribute to an integral part of daily diet in the region as the major sources of protein. Tripura, Assam and Arunachal Pradesh are the largest consumer of fish, although there remains considerable gap in demand and supply of fish and livestock products in north east. In Assam alone, the present annual fish production from all the sources is about 0.16 million tonnes as against an estimated demand of 0.21 million tonnes (Singh *et al.* 2014). Per capita availability of livestock products (milk, egg and meat) in the region also remain much lower than the national average (Borgohain and Deka 2015). Although livestock production in the region increased over time, self-sufficiency could not be achieved from domestic sources and the region till date continues to be a net importer. The frontline extension system can play a crucial role in bridging the gap between demand and supply of livestock products and fish in the region by means of designing suitable technological interventions. Although 13.96% of the SMSs of KVKs working towards livestock and fisheries development in the region had shown higher level of performance, the same of a majority (51.16%) require immediate boost up with proper guidance and measures.

The diversities in topography, altitude and climatic conditions in north eastern region offer ample scope for introduction and adoption of technologies related to cultivation of a wide range of horticultural crops including vegetables, fruits, flowers, tuber crops, spices and condiments. KVKs in the region although in recent years have introduced and standardized package of practices of high value fruit crops varying from highly temperate to subtropical as well as tropical, large scale adoption of those in a commercial scale is still awaited. Despite abundance of favourable factors and plenty of scope for an overall boom of horticulture sector in the region, it has hardly picked up the desired momentum (Sarmah and Deka 2012). The same is possible to achieve, provided the frontline extension machinery with its qualified manpower contributes to its highest extent. In course of the present study, it was found that 14.64% SMSs produced higher level of performance, 43.90% of themhad shown medium level of performance and there remains immense scope to immediately boost up performance of 41.46% of the SMSs. Apart from the physical, geographical, locational and connectivity factors, other factors (if any) restricting optimum level of their performance should be thoroughly investigated. Given the relative advantages of the region to produce a wide variety of horticultural crops including some unique fruit crops indigenous to the region, home-scale processing and value addition has huge scope. India wastes ₹ 130 billions of fruits and vegetables every year (Anon 2014) and the North Eastern states definitely renders a considerable contribution to that. As, lack of access to technologies and lesser motivation and interest on the part of the farmers results in the unintended wastage, the role of scientific extension should be emphasized to minimize the losses (Gills *et al.* 2015). In the meagre presence and growth of food processing industries in the region (Rais *et al.* 2014), micro level home-scale processing remains to be the most feasible option to reduce the overall wastage of fruits and vegetables and to fetch to the rural households significant income. Therefore, high quality intervention of the SMSs working towards home education and development with suitable technologies may be of immense impact in this particular regard. Suitable

performance enhancement intervention will result in achieving the same as the performance of 40.00% of the SMSs working in this direction had shown the urgency of the said intervention.

Correlates of performance

The CJPI scores obtained by the SMSs were correlated with different categories of variables- socio personal, psychological, organizational, natural and environmental, and capacity building and personal development. Out of eighteen independent variables under study, only eight variables produced significant correlation with job performance of SMSs. The eight variables having significant correlation with job performance were age, gender, team man-ship, support and professional mentorship received from the host institute, road and transport facilities, freedom from damage caused by harsh climate and wild animals, participation in knowledge sharing forum, and participation in training programmes (Table 4).

A multiple regression analysis run in SPSS (Ver. 16.0) showed that four independent variables- gender, physical facilities, support and professional mentorship received from the host institute and participation in knowledge sharing forum could significantly predict the outcome variable, job performance. Based upon the standardized regression coefficients (β) calculated for each of the predictor variables, the regression equation reached could be represented as: Y= 0.13X17-0.13X5-0.25X10-0.29X12+0.13+0.04 (where, Y= Job performance, constant= 0.16 and standard error= 0.04). Based on coefficient of determination (R^2), only 19 % of the variation could be explained in the present study that imply that there are other unidentified variables contributing to the variation not included in the present study. Hence, there is a scope to identify and assess the contribution of other important variables in this regard through future research.The significant F ratio indicated that the regression model had significantly predicted the outcome variable job performance.

It is evident from findings of the study that there remains ample scope for improving performance of the individual SMSs and thereby the overall functioning of the frontline extension system in north eastern region. The following policy measures are suggested in light of the findings: (1) As conduct of meaningful on-farm trials and frontline demonstrations in the disciplines of Agricultural Extension and Agricultural Economics lacked clarity in understanding, a standard protocol for conducting the same may be devised after organizing a national level workshop. (2) As the physical facilities present in the KVKs like office building, working space in the office, training hall etc. and boundary fencing to protect KVK farm from encroachment and damage served as important determinants of performance as found in course of the present study, adequacy and timely arrangement of the same should be ensured. (3) As realized in course of the present study, participation in knowledge sharing forums and training programmes were important determinantsof performance. Therefore, the KVK, SMSs should be encouraged regularly to participate in such programmes. (4) Support and professional mentorship received from the host institute was perceived as a crucial factor for higher level of performance, hence a short duration professional mentorship programme may be initiated by the host institutes for the newly recruited SMSs. An expert committee for mentorship and support may be formulated by head of the host institutes of respective KVKs.

Table 4 Association of different socio-personal, organizational and other characteristics to job performance of respondent SMSs (n=231). Dependent variable – composite job performance

Independent variable	Correlation coefficient(r)	Standardized regression coefficient (β)	t value
Socio-personal			
Age	0.10*	0.10	1.09
Professional experience	0.02	-0.01	-0.15
Educational qualification	0.03	0.03	0.46
Marital status	0.02	-0.03	-0.46
Gender	-0.09*	-0.13	-2.06**
Psychological			
Achievement motivation	0.039	0.01	0.07
Observed team-man-ship behaviour	0.11**	0.02	0.17
Organizational			
Organizational atmosphere	0.10	-0.06	-0.68
Technology application and capacity development facilities	0.10	0.08	0.90
Physical facilities	-0.10	-0.25	-3.08***
Geographic location of the KVK	0.05	-0.02	-0.27
Support and professional mentorship received from the host institute	0.28***	0.29	3.52***
KVK farm for experimentation and demonstration	0.05	0.001	0.01
Task-remuneration balance	0.07	-0.01	-0.06
Natural and environmental			
Road and transport facilities	0.10*	0.002	0.03
Freedom from damage caused by harsh climate and wild animals	0.11**	0.04	0.59
Capacity building and personal development			
Participation in knowledge sharing forums	0.21***	0.13	1.86*
Participation in training	0.22***	0.04	0.39

*Significant at 0.10 level of probability,**Significant at 0.05 level of probability, ***Significant at 0.01 level of probability. (Source: Authors' calculation. R^2= 0.19 F= 2.74***).

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