Indian Journal of Agricultural Sciences **85** (6): 838–44, June 2015/Article
https://doi.org/10.56093/ijas.v85i6.49257

Developing linkages for agricultural technology transfer: A case study of research institution and voluntary organization partnership

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Received: 27 November 2014; Accepted: 23 March 2015

ABSTRACT

A paradigm shift to the private and voluntary organizations led extension is being witnessed as the public agricultural extension system has been adversely affected by various constraints. ICAR-Indian Agricultural Research Institute (IARI) a premier agricultural research institution took lead to develop linkages with voluntary organizations (VOs) of repute for speedy transfer of agricultural technologies to the ultimate users. The present study was conducted on randomly selected 120 farmers of Patiala district to analyze the effectiveness of IARI linkage with VO namely Young Farmers' Association (YFA) of Punjab state. The advisory services through IARI-YFA linkage, higher yield of IARI released varieties, social participation of farmers and their education were the major determinants for the adoption of IARI varieties. In case of both rice and wheat, IARI varieties were sown in more than 60% area of the total land holdings of the farmers. Although, the linkage was perceived highly effective in terms of the delivery of farm technologies, advisory services, farm literature supplied, farmers' fair, front line demonstrations, impact on yield and income of farmers and satisfaction of farmers but non-availability of seeds in desired quantity, higher seed cost and less land for seed multiplication were major inhibiting factors. The functional efficacy of linkage may be enhanced through close collaboration of state level government and private agencies for broad based, inclusive and sustainable agricultural development.

Key words: Adoption, Advisory services, Facilitating and inhibiting factors, Farmers' satisfaction, IARI technologies, Voluntary organization

Diversification of agricultural extension services is indispensable to increase the competitiveness of service providers. To offer a wide range of services to serve a varied demand of user groups, extension agencies in agriculture require a large number of partner organizations proficient in effectively supplementing and complementing their expertise. Agricultural and rural development strategies would benefit from increased collaboration between government research and extension organizations and non-governmental development organizations (Korten 1987). Non-governmental organizations (NGOs) are transferring technologies through several innovative dissemination methods which have been developed by relying on both group or individual farmer-to-farmer contact methods (Sollows *et al.* 1993). Also they have pioneered a broad variety of participatory methods for diagnosis of the problem and to find the relevant solutions to them besides testing new technology in rural contexts (Sotomayor 1991). Small farmers, including women from poor families, can be reached through Government Organizations (GO) and NGO partnerships. With NGOs' strength in motivating farmers and the GOs' technical competence, this partnership pattern can reach more small and marginal farmers (Ojha and Morin 2001). However it varies in the reciprocal realistic requirements; for NGOs, these include the need to access technical or managerial resources, to gain legitimacy or recognition, to encourage greater accountability and precision and to encourage reform in public systems. GOs on the other hand work with NGOs to improve people's involvement in their programmes, to broaden coverage of programmes to areas and groups that are poorly served by it, to test and replicate innovative models and to attain more cost effectiveness (Arya 1999).

Indian Agricultural Research Institute, New Delhi popularly known as Pusa Institute is a premier public funded institution involved in basic and strategic agricultural research, post graduate teaching and transfer of farm technologies to ultimate users since 1905. The seeds of green revolution in India during 1960s and 1970s were bred and transferred to farmers from the fields of the Institute. The institute is credited for initiation, validation and

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development of various technology transfer models implemented in Indian subcontinent like Seed Village, 'National Demonstration', 'Lab to Land Programme', 'Farmers' Participatory Seed Production' and 'Agricultural Technology Information Centre (ATIC)'. Having edge in developing crop varieties and tailored farm technologies for all the agro ecological zones of India at its nine research stations across the country IARI experimented on innovative outreach programme focusing on partnership with voluntary organizations (VOs) of repute for technical backstopping and real time transfer of agricultural technologies to the ultimate users and selected 31 such VOs across 17 states of country during 2009 and conducted 281 demonstrations of ten crops during *rabi* 2009-10. The intensity in terms of number of demonstrations and crops is increasing since 2009. The voluntary organization namely Young Farmers Association (YFA) with its headquarters at *Rakhra* District Patiala, Punjab state having strength of more than ten thousand farmer members is one among those selected for developing linkage through technical and research backstopping. YFA has its own farm for seed multiplication and demonstration of other technologies, monthly publication namely *Young Farmer* in local language (Punjabi) for information dissemination, the biannual Farmers' Fair (Rakhra krishi mela) for technology promotion, infrastructure for entrepreneurial training in agriculture and systematic mechanism for farmers' exposure visits to IARI and other institutes of importance. The present study was undertaken to analyze the perceived effectiveness of the linkage programme from farmers' point of view to meet the objective of reducing time lag in diffusion and adoption of IARI technologies and also to document the facilitating and inhibiting factors of linkage programme.

MATERIALS AND METHODS

An exploratory research design was used for conducting the study in purposively selected Patiala district of Punjab state of India. From the selected district, two community development blocks namely Nabha and Ghanaur were selected randomly. From each selected blocks two villages namely Rakhra and Khokh from Rakhra and Sanjarpur and Lanja from Ghannaur were selected randomly. Thirty rice and wheat growing farmers were selected randomly from each selected villages making a total of 120 respondents for the study.

A pre-tested interview schedule containing items related to eight measures of effectiveness of technology transfer was used to collect the data from respondents. The measures of effectiveness included; Seed supply, advisory services, demonstrations of crop varieties, farm publication, Rakhra krishi mela, extent of adoption of recommended package of practices, increase in yield and level of farmers' satisfaction. The perceptions of the farmers were sought on five dimensions namely availability/ usefulness, accessibility/ comprehensibility/interesting, timeliness, quality and problem solving/cost consideration of each measure of effectiveness as the case may be. The dimensions for effectiveness were assessed using a Likert type five point continuum. The continuum selected were very low (0-20 score), low (21-40 score), medium (41-60 score), high (61-80 score) and very high (81-100 score). An effectiveness index was developed for assessing the overall effectiveness for the linkage programme. To analyse the diffusion of IARI technologies, the adoption of IARI released rice and wheat varieties by the selected farmers over a period of three years, i.e. 2010-11, 2011-12 and 2012-13 were considered. Personal interview were conducted with the selected respondents to collect the data. Focus group discussions were also organized to identify facilitating and inhibiting factors of the IARI- YFA linkages program. The respondents were then separately asked to list down and rank the perceived facilitating and inhibiting factors.

Descriptive statistics were used to analyze the data using SPSS. The linear regression model was used to identify factors influencing the adoption of IARI varieties by farmers. The functional form fitted was specified as:

$$Y = A + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + e$$

where, Y, adoption of IARI varieties; A, constant; e, error term; B_1-B_7, coefficients; X_1, age of head of household (years); X_2, availability of credit (Yes =1, No =0); X_3, extension contact (frequency of exposure of farmers to IARI-YFA linkage extension); X_4, farming experience (years); X_5, social participation (non-member=0, member=1, chairman=2); X_6, total output of farmer (Kg/ha); X_7, level of formal education (years spent in school).

Garrett ranking technique was used to rank the inhibiting factors. As all the items were not ranked by all the respondents, the method of combining of incomplete order of merit ranking as suggested by Garrett (1979) was followed. By using this technique, the order of the merits given by the respondents was changed into ranks by using the following formula:

$$\text{Percent position} = 100 * (R_{ij} - 0.5)/N_j$$

where, R_{ij}, rank given for i^{th} factor by j^{th} respondent; and N_j, number of factors ranked by j^{th} respondent.

RESULTS AND DISCUSSION

The results of the study have been presented in three broad heads; adoption of IARI varieties, effectiveness of linkage programme and facilitative and inhibiting factors in linkage programme.

Adoption of IARI varieties

Table 1 shows that since the last three years (2010-11 to 2012-13), respondents were increasingly adopting the latest released HD 2967 variety. HD 2733 and HD 2894 were the second and third most preferred variety. Major portion of land of farmers are covered by varieties released from IARI. In the year 2012-13, HD 2967 was the most popular variety among the farmers which was sown in almost 38% area of the total area of the respondents. Other

Table 1 Percentage area under different wheat and rice varieties adopted by the respondent farmers (n=120)

Wheat				Rice			
Varieties	2010-11	2011-12	2012-13	Varieties	2010-11	2011-12	2012-13
HD 2967	15	20	38	Pusa 44	61	63	64
HD 2733	33	32	21	PR 118	6	5	4
HD 2894	12	11	7	PR 114	3.7	4	3
PBW 621	6	7	9	HKR 47	3.6	5	3
PBW 550	8	8	7	Pusa 1121	22	20	22
PBW 502	12	2	5	Others	4	3	4
DBW 17	7	15	9				
Others	7	5	4				

important variety among the farmers is HD 2733, however, after release of HD 2967 the area decreased. The area under non IARI varieties (PBW 550, PBW 502, DBW 17, and PBW 621) was reported to be in decreasing order with 40, 37 and 34% in 2010-11, 2011-12 and 2012-13 respectively.

Table 1 further show that among non-basmati rice varieties Pusa 44 was the most adopted variety in almost 64% of the rice area. Among the basmati (scented) varieties Pusa 1121 was the most widely adopted variety among the farmers in almost 22% of the area under rice. Other varieties such as PR 118, PR 114 and HKR 47 were also adopted by the farmers but in very lesser area. Farmers were giving high preference to IARI released varieties, which were effectively disseminated as a result of IARI-YFA linkage program in the region.

Result of regression analysis in Table 2 reveals that four variables were found to be significant in relation to the adoption of the newly released IARI varieties. The variables; extension intervention of IARI-YFA linkage (frequency of exposure of farmers to IARI-YFA linkage), level of social participation, level of farmer's education and total yield obtained by the farmer were found to be significant at 1, 5, 5 and 10% level of significance respectively. The extension intervention was significant at 1% level of significance with positive coefficient which indicates that there is a positive relationship between extension intervention and adoption of IARI technology. Social participation of the farmer was found to be significant at 5% level of significance. This implies that there is a direct relationship between adoption of IARI varieties and social participation of the farmers. Bandiera and Rasul (2002) reported that the probability of adoption was higher amongst farmers on discussion of agriculture with others in their social networks in Northern Mozambique. Education level of farmers being significant at 5% level implies that with increase in education level adoption level also increases. This result is consistent with Zavale *et al.* (2005), who reported a positive and significant effect of education on the probability of adoption of improved maize seeds. The coefficient of total yield obtained by the farmer was positive and significant at 10% level of significance. Yield is a direct measure of new varieties which attract the farmers for its subsequent adoption because high yield would raise their economic prosperity. Once a year's harvest is realized, the farmer then updates his priors concerning the technology which may increase his probability of adopting the new technology in the subsequent year.

Table 2 Regression analysis of the socio-economic determinants of adoption of IARI varieties (n=120)

Variable	Coefficient	Sd Errort	Statistic
C	–2.078	0.67	–3.10149
X1=Age of head of household (years)	0.021	0.015	1.4
X2= Availability of credit (Yes=1, No =0)	0.079	0.047	1.680851
X3=Extension contact (frequency of exposure of farmers to IARI-YFA linkage extension)	0.563***	0.179	3.145251
X4= Farming experience (years)	0.015	0.012	1.25
X5=Social participation (non-member=0, member=1, chairman=2)	0.373**	0.151	2.470199
X6= Total output of farmer (kg/ha)	0.278*	0.105	2.647619
X7=Level of formal education (years spent in school)	0.373**	0.211	1.767773

R^2 value =0.71, ***, ** and *indicate significance at 1, 5 and 10% level of significance, respectively.

Effectiveness of linkage programme

Seed supply: The Table 3 showing the farmers' perceptions on seed supply system of selected VO depicts that majority of the farmers rated all five measures (availability, accessibility, quality, timeliness and cost) between high and very high except the cost which was rated between high and medium. The overall mean score was highest for quality (84.6) followed by timeliness (80.0), accessibility (70.0), availability (70.0) and cost (64.0). As such VO in collaboration of research support was playing a vital role in dissemination of improved varieties, David (2003) also concluded similar findings and advocated the proliferation of NGO and research support to local rural level seed production and dissemination activities. The seed quality was rated very high by the farmers as it can play a critical role in increasing agricultural productivity and thus food security as well as farmers' incomes. It determines the upper limit of crop yields and the productivity of all other agricultural inputs into the farming system (Maredia *et al*. 1999). As the cost of seed recovered by VO was perceived high, the farmers need to be motivated to stretch their investment capacity by increasing their confidence in recommended technologies and pressing hard for the matching supply system to the concerned agencies through extension system (Singh *et al*. 2011)

Advisory services: Advisory services are provided to the farmers at YFA campus, Rakhra. The services include crop advisory services, farm machinery services, services in the form of entrepreneurial training etc. The service

Table 3 Perceptions on different measures of effectiveness of linkage(n=120)

Measure	Category	Very low	Low	Medium	High	Very high	Mean
Seed supply system	Availability		16 (13.3)	16 (13.3)	40 (33.3)	48 (40.0)	70.0
	Accessibility			20 (16.6)	80 (66.7)	20 (16.6)	70.0
	Quality				32 (26.6)	88 (73.3)	84.6
	Timeliness			10 (8.3)	35 (29.1)	75 (62.5)	80.0
	Cost			36 (30.0)	84 (70.0)		64.0
Advisory services	Availability			30 (25.0)	54 (45..0)	36 (30.0)	71.0
	Accessibility				84 (70.0)	36 (30.0)	76.0
	Problem solving				48 (40.0)	72 (60.0)	82.0
	Timeliness				40 (33.3)	80 (66.7)	83.3
	Relevancy			12 (10.0)	28 (23.3)	80 (66.7)	81.0
Demonstrations	Motivating			12 (10.0)		108 (90.0)	86.0
	Accessibility				60 (50.0)	60 (50.0)	80.0
	Problem solving			10 (8.3)	34 (28.3)	76 (63.3)	81.0
	Timeliness				40 (33.3)	80 (66.7)	83.3
	Relevancy				46 (38.3)	74 (61.7)	82.0
Farm publication	Credibility			16 (13.3)	32 (26.7)	72 (60.0)	79.3
	Comprehensibility			36 (30.0)	40 (33.3)	44 (36.7)	71.33
	Problem solving			32 (26.7)	64 (53.3)	24 (20.0)	68.6
	Timeliness				80 (66.7)	40 (33.3)	76.6
	Relevancy		36 (30.0)	48 (40.0)	36 (30.0)		50.0
Rakhra krishi mela	Useful			12 (10.0)	30 (25.0)	76 (65.0)	81.0
	Interesting			70 (58.3)	50 (41.7)		58.3
	Problem solving			16 (13.3)	84 (70.0)	20 (16.7)	70.6
	Timeliness			12 (10.0)	40 (33.3)	68 (56.7)	79.3
	Relevancy				84 (70.0)	36 (30.0)	76.0
Adoption of recommended practices of rice and wheat and yield increase	Adoption				48 (40.0)	72 (60.0)	84.5
	Increase in yield			20 (16.6)	60 (50.0)	40 (33.3)	73.3
Farmers' satisfaction with advisory services	Level of satisfaction			12 (10.0)	60 (50.0)	48 (40.0)	76.0

Figures in parenthesis shows respective percentages

component was further sub categorized under availability, timeliness, problem solving, relevancy, and accessibility. It was perceived to be medium in availability by 25% of the farmers, high by 54% and very high by 30%. Timeliness of services was found to be very high by majority of farmers (66.6%) and high by 33.3%. In case of problem solving nature of services it was found to be very high by majority of farmers (62%) and high by 40% of them. Relevancy was perceived to be medium by 10%, high by 23.3% and very high by 66.6% of the farmers. It case of accessibility it was found to be high by 70% of farmers and very high by 30% of the farmers.

Demonstration through YFA: Improved crop-varieties developed by IARI are demonstrated at the YFA farm at Rakhra campus in Patiala district. Farmers in the area get an excellent opportunity to receive the firsthand knowledge of new varieties; also they can receive answers to their queries. The opinion of the respondents regarding its accessibility, timeliness, problem solving nature, relevancy and motivating in nature were sought. The demonstrations at the Rakhra farm laid out through YFA-linkage with IARI were found to be high in accessibility by 50% of the farmers and very high by 50%. Timeliness of demonstration was found to be very high by majority of farmers (90%) and medium by 10%. In case of problem solving nature it was found to be medium by 8.3%, high by 28.3% and very high by 63.3% of farmers. Relevancy of demonstration was reported to be high by 38.3% and very high by 61.6% of farmers. Motivating in nature was found to be medium by 16.6%, high by 23.3% and very high by 60% of farmers.

Farm publications: YFA publishes popular monthly magazine carrying relevant information for farmers. It is circulated free of cost to its member farmers and for non-member farmers it is sold at a very nominal charge. The perception of farmers regarding its farm periodical shows that the farm magazine published by YFA in terms of

credibility was found to be medium by 13.3%, high by 26.7% and very high by 60% of farmers. In case of its timeliness it was perceived high by majority (66.6%) of the farmers and very high by 33.3% of them. Problem solving in nature was found to be medium by 26.6% of farmers, high by majority (53.3%) and very high by 20% of farmers. In case of relevancy it was found to be low by 30% of farmers, medium by 40% and high by 36%. Its comprehensibility was perceived medium by 36%, high by 33.3 and very high by 36.6% of farmers.

Rakhra krishi mela: The YFA at Rakhra campus organizes two krishi melas in a year, each organized just before the onset of (*rabi* and *kharif*) cropping seasons. It facilitates the delivery of different services like quality seeds, crop advisory services, farm machinery services, entrepreneurial services, communication services, diagnostic services etc. For the purpose of study the perception on usefulness, timeliness and problem solving, relevancy and interesting nature were sought from farmers and the results shows that farmers perceived krishi melas to be very high in usefulness by majority (65%), very high timely (56.7%), high in problem solving nature (70%) and very high by 16.6% of them and medium by 13.3% of farmers. However, majority of the farmers (58.3%) perceived krishi mela as medium in interest and 41.6% farmers as high in interest.

Extent of adoption of recommended practices and increase in profit: The results of the perceived yield increase and profit shows that for 16.7% farmers perceived that increase in yield was about 11-15%, whereas majority (50%) of farmers viewed that yield increased up to 16-20%, only 33.3% of farmers perceived the yield increased up to the extent of 21-25%. Majority of farmers (60%) had adopted the recommended practices at very high level and 40% of farmers adopted the recommended wheat and rice practices at high level (Table 3).

Satisfaction with extension services: The objective of extension services is to increase farmers crop yield, income and other attributes which leads to increase in farmers' satisfaction. An index of farmers' satisfaction on the pattern of Kumar (2005) an index was devised having seven items which were sought at five point continuum and it is clear from the results that majority of the farmers (50%) had high levels of satisfaction, whereas 40% of farmers had very high level of satisfaction with extension services offered by linkage.

The IARI-YFA linkage programme was playing vital role in rapid dissemination of different seed varieties to the farmers. The seed supply through IARI-YFA linkage was better in quality and timeliness. The cost of seeds, accessibility as well as availability in appropriate amount, however, somewhat lesser favoured as compared to other extension agencies. The services offered were timely and problem solving in nature. The linkage was efficient in offering extension services like demonstration, farm-publications etc. Intervention of VO-based extension services has changed the farming scenario by providing appropriate technology, market, input and information support increased yields and income of the farmers to a great extent which might have led to high farmers' satisfaction. The effectiveness of IAR1-YFA can be further increased by reducing the cost of inputs and making partnership with Government and other agencies.

Facilitative and inhibiting factors in linkage programme

Table 4 shows that 'Quick dissemination of improved varieties and advisory services', along with 'high profitability of IARI varieties' were the most important facilitating factors with the mean score of 73.26 and 62.70 respectively. 'Interaction with IARI scientists and farmers' (55.88), 'non-profit orientation of YFA'(52.39) and 'Strong membership of YFA' (48.09) were ranked third, fourth and fifth facilitative factors respectively. 'Good rapport of IARI among Punjab farmers'and 'Nearness of Patiala and IARI' were ranked next in order. IARI varieties have proved to be high yielder as well as more profitable, so they are in great demand among the farmers of the region. Since several scientists of IARI visit the Rakhra farm for different purposes as well as act as resource person in the interaction meets of the farmers, organized during krishi melas, farmers are motivated to use IARI released varieties. Young Farmers' Association being a NGO, having a 'not for profit' motive better serves the needs of the farmers. A strong membership of almost 10 000 farmers gives an immense platform for interaction through linkage programme in disseminating the technologies to non-member farmers as well. Similarly, Thomas *et al.* (2008) reported broad network, good community-based experience and more horizontal linkages to be the strengthening factor for NGO's. High reputation and rapport of IARI, being a premier institute for agricultural research, education and extension, among Punjab farmers, they always bank upon it for high yielding crop varieties. Proximity of Patiala and New Delhi through convenient transport also provides opportunity for greater influence of IARI on the farmers of the region.

The inhibiting factors were studied in terms of organizational and functional nature. In addition to the selected farmers the focused group discussion with YFA

Table 4 Facilitative factors in the IARI-YFA linkage program (N=120)

Factors	Mean score	Rank
Quick dissemination of improved varieties and advisory services	73.26	I
High profitability of IARI varieties and related technologies	62.70	II
Farmers' opportunity of interaction with IARI scientists through different platforms like *krishi melas*, field visit, FLD etc.	55.88	III
Not for profit orientation of YFA	52.39	IV
Strong membership of YFA	48.09	V
Good reputation of IARI among Punjab farmers	46.56	VI
Nearness of Patiala and IARI	43.89	VII

Table 5 Inhibiting factors in implementation of linkage programme

Factors	Mean Score	Rank
Organisational		
Less field area for seed production	77.15	I
Lack of financial resources	66.60	II
Lack of high-tech warehouse	58.79	III
Lack of grading machines and packaging machines	51.28	IV
Lack of proper training	46.08	V
Lack of job security of staff members	45.46	VI
Functional		
Inadequate quantity of seeds	70.00	I
High price of inputs	61.25	II
Lack of supply of other necessary inputs	55.62	III
Less number of training to farmers	52.34	IV
Lack of diversification of technology	48.50	V
Political hindrance & progressive farmer approach	37.35	VI

functionaries on the issue was organized. Table 5 shows that 'less field area for seed production' and 'lack of financial resources' were the major organizational constraint with the mean score 77.15 and 66.60 respectively. As there is only 28 acres of land with YFA, to meet the increasing demand of seeds by farmers, YFA needs more land area to increase seed production. Lack of required financial resources was challenging the sustainability of the YFA, same constraint was reported by Julie Flament *et al.* (2012) and Thomas *et al.* (2008). 'Lack of high-tech warehouse' and 'lack of modern grading and packaging machines' were ranked third and fourth with the mean score 58.79 and 51.285 respectively. 'Lack of proper training' and 'lack of job security of staff members' were ranked fifth and sixth. IFPRI report (2009) support the finding, whereas it was reported that the lack of fund as well as lack of trained staff were a major impeding constraints in private firms. The field functionaries get training in case of principle knowledge from the IARI scientists but the training in extension approach was lacking. Regarding functional factors; 'lack of adequate quantity of seeds' and 'high price of seeds due to lack of government subsidy' were the predominant impeding factors faced by the farmers with the mean score 70.0 and 61.25 respectively. 'Lack of supply of other necessary inputs', 'and 'less number of trainings to farmers' were ranked next in order with the mean score of 55.62 and 52.34 respectively. Less intensity of advisory work perceived as a constraint by the farmers was also reported by Raju *et al.* (2001). 'Lack of diversification of technology' and 'Political hindrance and progressive farmer approach' were ranked in lower order. The same issue was highlighted in research report of IFPRI (2009).

It was concluded that the linkage programme was found very effective in speedy delivery of technologies to the ultimate users. However the cost of the seed may be reduced by developing partnership with government organization and other agencies involved in similar type of advisory and delivery services for the farmers. Government organizations and VOs must change from using production figures as sole targets for their planning and instead focus on how they can help agriculture stakeholders in maximizing farm profit and make farming sustainable. The variety of services and deliverables may be increased as most respondents' expectations for quality pesticides, fertilizers, custom hiring of farm machinery and marketing assistance was observed. The functional effectiveness may be increased by working in close collaboration of state level agencies like ATMA for exposure tours of farmers, infrastructure development and human resource development for better coverage of all segments of the society including small and marginal farmers, women and perspective agripreneurs.

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