ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

RESEARCH-EXTENSION-FARMER LINKAGE SYSTEM IN PUNJAB AGRICULTURE

Manmeet Kaur and Ravinder Kaur
Department of Extension Education, Punjab Agricultural University, Ludhiana, Punjab, India .

Manuscript Info

Manuscript History:

Received: 15 November 2013
Final Accepted: 29 November 2013
Published Online: December 2013

Key words:
Research; Extension; Extent of linkages; Linkage mechanisms; Perception.

Abstract

This paper analyses the Research-Extension-Farmer Linkage system in the agriculture sector of Punjab state in India. An investigation was carried out at the Punjab Agricultural University (PAU) headquarters in Ludhiana district and in the three other districts viz. Faridkot, Sangrur and Hoshiarpur of the state of Punjab, India. Survey technique was used to know the perception of 150 researchers and extensionists of PAU and State Department of Agriculture, Punjab towards their kind and extent of linkages amongst each other as well as with the farmers. Data was also recorded regarding their participation in various linkage mechanism areas with each other as well as with the farmers. The results of the study revealed that researchers and extensionists perceived low to medium linkages amongst each other and medium to high linkages with the farmers while less than half of the researchers and extensionists perceived that they had low extent of participation in linkage mechanisms with each other (43.3%) and medium extent of participation with farmers (45.3%). The authors proposed that Participatory Technology Generation and Participatory Conduct, Monitoring and Evaluation of research and extension activities should be used to enhance the research-extension-farmer linkages. Formation of Village Knowledge Centres and farmer's organizations will also help to foster these linkages in the state.

Introduction

Literally, link means anything serving to connect or tie. Linkage is a cluster of channels, which connect one major component with other major components (Axinn and Thorat 1972). The concept of linkage implies the communication and working relationship established between two or more organisations pursuing commonly shared objectives in order to have regular contact and improved agricultural productivity. (Havelock 1986) contends that linkage is a term used to indicate that two systems are connected by messages so as to form a greater system. Linkage mechanism refers to the concrete procedure, regular event, arrangement, device or channel which bridges the gap between the researchers, extensionists and farmers and allows communication between them. Research and technology transfer institutions, managers, units, or personnel may link with each other for six broadly defined functions viz. Planning and review; Collaborative activities; Exchange of resources; Dissemination of knowledge and information; Evaluation and feedback and Coordination (Eponou 1993). In agriculture sector; research, extension and farmers are three systems which are linked by information flow and feedback. Linking roles had been closely related to the dissemination and utilization of knowledge. The natural starting point for the discussion of linking role is knowledge gap i.e. the situation for which linkage is required (Havelock *et al* 1971). The need for some kind of linking system to bridge the gap between the research and client systems has also been stressed by many social scientists (Allen 1977; Kunju 1992 and Crowder and Anderson 1997). For effective transfer of technology, strong inter-organisational linkage is of vital significance because of the involvement of various organisations in the process (Sen 1984) and weak linkages among research, education and extension institutions

result in systematic bottlenecks in national agricultural technology systems and limit their effectiveness to contribute to development (Roling 1989 and Kaimowitz 1989).

While an elaborate research extension linkage mechanism has been established in India for the past one and a half decade, actual functioning and quality of interactions in these foray leaves much to the desired (Anonymous 1992). Scientists get the feedback about farmers' problems through official records of the disseminating agencies (Rathore 2000) and the experts do not have regular direct contact with the farmers (Intodia 1998). Though a formal mechanism of linkage exists at various levels, the linkage has not been found to be effective in actual sense on the part of all the scientists. Apart from selected master trainers, the direct linkage of the scientists with the farmers is limited to lectures. The monthly workshops are the places where scientists and extension functionaries meet to work out technology packages relevant for the coming months, but, these workshops have become routinized and repetitive (Sabarathnam 2000) without adequate preplanning. Eponou in 1993 concluded in his study that there was no relationship between the number of linkage mechanisms in the system and the level of integration of research and technology transfer, rather, in some cases time was wasted because the mechanisms could not be properly used or were inappropriate.

The research-farmer linkages mediated by the extension system played a crucial role in the advancement of food security through the Green Revolution in India in the '60s and '70s (Chaudhary et al, 2011). The state of Punjab was the first one to reap the benefits of Green Revolution (Kohli and Singh, 1995; Preet, 2006; Newman, 2007). Apart from the hard work of the Punjab farmer, quick dissemination of technological information from the agricultural research system to the farmers in the field and reporting farmers' feedback to the research system is one of the critical inputs in transfer of agricultural technology. Punjab Agricultural University (PAU) was established in 1962 to serve the state of erstwhile Punjab. Modeled on the pattern of land grant colleges in U.S.A., PAU performs the integrated functions of teaching, research and extension in agriculture and allied disciplines. PAU has played a key role in increasing food grain production in the state by developing appropriate technologies and effective mechanism for the transfer of technology to the farmers and agricultural organisations through different extension programmes. Need based technology development and refinement are continuous processes in which research and extension components work hand in hand. The university research system works through its Directorate of Research at PAU headquarters, Ludhiana as well as through its regional crop research stations at various places in the state. The university extension service under the Directorate of Extension Education maintains live and intimate links with the research departments on one hand and the field level functionaries of different state departments, development agencies and farmers on the other hand (www.pau.edu). Apart from rendering the extension services from the headquarters at Ludhiana, PAU is also adhering to location specific needs of the farmers through its 17 Krishi Vigyan Kendras (KVKs) working in different districts of the state. The KVK project is sponsored by the Indian Council of Agricultural Research (ICAR) and is implemented by the ICAR institutes, State Agricultural Universities, reputed Non-Governmental organizations (NGOs) and State Departments of Agriculture. The KVK is a district level Farm Science Center established by the ICAR, New Delhi for speedy transfer of technology to the farmers' fields. The KVKs are designed to impart need based and skill oriented vocational trainings to the practicing farmers, in service field level extension workers and to those who wish to go in for self employment. KVK system is a massive set up. It is a joint initiative powered by multidisciplinary team and farmers who are in a way partners in assessing, generating, refining and adopting knowledge based farming. (Sidhu and Khera, 2007).In recognition of its outstanding achievements in agricultural research, education and extension, PAU was adjudged the Best Agricultural University in India in 1995 by the Indian Council of Agricultural Research (www.pau.edu; www.indianjournals.com).

But PAU has a limited reach to the farmer and the major responsibility of transfer of agricultural technology in the state lies with the State Department of Agriculture, Punjab. It is one of the main development departments working for the welfare of the farmers of the state. The major function of this department is to communicate the latest agricultural technology to the farmers through different methods and media. Director of Agriculture, Punjab is managing, supervising and controlling the various functions of the department and the Agricultural Development Officers (ADOs) are responsible for communicating the latest farm innovations, agricultural programmes and policies to the farmers at grass root level. The responsibility of linking up the farmers with research scientists lies mainly with the ADOs.

In recent years, two major concerns have been raised regarding the relative failure of research-extension services in increasing agricultural production: first, the research problems being investigated are generally not in accordance with the priority needs of agricultural producers and second, the knowledge generated at the research stations have not been effectively transferred to the producers (Asopa and Beye**,** 1997). The age old problem of weak linkages between research and development and extension continues to beset the flow of information,

knowledge and resources among actors in the technology-delivery-utilization system (Jaiswal and Arya 1981; Singh 1984; Arnon 1989; Rehiman *et al* 1991 and Sinha 1996). In many countries, the insufficient agricultural development has been attributed, among other factors, to poor linkages between research-extension-farmers and to ineffective technology delivery systems, including poor information packaging and lack of communication systems (FAO, 2004). The lack of strong linkage causes disruption in technology flow and low adoption rates, increased time lags between development and adoption of new technology, reduced efficiency in the use of resources, unnecessary competition and duplication of efforts and increased cost of agricultural research and extension activities (Arnon, 1989; Ashraf et al, 2007)**.** Too often, research and extension have become top-down, bureaucratic organizations that are not receptive or responsive to the needs of farmers (Swanson 1997). There is a growing mountain of shelved, perfected yet unutilized research outputs, and there are large amounts of information getting tied up in journal publications targeted to peer groups rather than intended beneficiaries (Smith et al, 2004) who rarely have access nor understand such publications. The ineffective links between research and extension has impeded the development and transfer of technology appropriate for small-scale and resource poor farmers. This is a one way linear process or a progressive farmer approach. For research to be more relevant to the farmers there is a need to create a participatory approach that emphasizes agricultural research and extension linkage and allows farmers to choose appropriate technologies from research stations, thereby eliminating the perception that extension system is separate from the research system (Thomas, 2012). Approach of farming system research rests on two central positions i.e. effective research on agricultural technology starts and ends with farmer and that integration of perceptions of biological scientists and social scientists is an essential element in such a research (Prasad and Reddy 1986). It is argued that farmers generate and use knowledge, and are constantly experimenting to manage risks and improve their operations. They should therefore be the natural partners of researchers (Smith *et al* 2004) for a mutual exchange and reconciliation of modern and traditional knowledge.

The lack of effective linkages and understanding of their importance among researchers and farmers may explain the present low adoption of technology and minimal research utilization in agricultural production systems. Wheat, paddy and cotton are the major crops grown in the state of Punjab, India. PAU has given a number of recommendations for these crops since its inception. Research studies conducted on the adoption of recommendations of these crops revealed that the extent of adoption was very low among the farmers. (Chahal *et al*, 2009 a,b,c)

Inspite of the strong linkage mechanisms being observed in Punjab in the form of annual *Rabi* and *Kharif* Research Extension Specialists' Workshops, Fruit and Vegetable workshops, Block Level Training Camps, District Level Training Camps, Scientific Advisory Committee meetings, etc., adoption gaps can be seen to a great extent in the predominant crops of the state. One of the reasons behind this may be that research-extension-farmer linkages may not be as strong as they seem to be and the linkage mechanisms may have become a customary affair. The researchers in this study sought to explore the existing research-extension-farmer linkages in Punjab agriculture and suggested various strategies to enhance these linkages.

MATERIAL AND METHODS

The State of Punjab has been classified into three agro-climatic zones viz. south western zone, western plain zone and sub-mountain undulating zone on the basis of homogeneity, rainfall pattern, distribution, soil texture, cropping patterns etc. The study was conducted in the year 2012 in three agroclimatic zones of Punjab. One district was randomly selected from each zone i.e. Faridkot, Sangrur and Hoshiarpur respectively. The investigation was also carried out at PAU headquarters which is located at Ludhiana district of Punjab state.

The study comprised of researchers and extensionists from PAU and extensionists from State Department of Agriculture, Punjab. The study sample comprised of a total of 150 researchers and extensionists. All the 32 ADOs, nine researchers on the research stations and 15 subject-matter specialists from KVKs in the selected districts were selected for this investigation. At the PAU headquarters in Ludhiana district, two colleges viz. College of Agriculture (COA) and College of Agricultural Engineering & Technology (COAE&T) were selected for the present study as they were more involved with the activities pertaining to agriculture. A total of 21 extension specialists i.e. 15 from different departments of the two colleges and six from the Directorate of Extension Education were selected randomly for this study. Also, 73 researchers were selected from the two colleges on the basis of probability proportional to total number of researchers in each college. Thus 61 researchers from the COA and 12 from COAE&T were selected.

Survey technique was used to collect the information regarding different forms of research-extension-farmer linkages existing in Punjab, extent of these linkages and extent of participation of researchers, extensionists and farmers in the linkage mechanisms areas of planning and designing; execution and dissemination; capacity building; monitoring and evaluation; interaction and communication and decision making. A semi-structured

interview schedule consisting of statements pertaining to the kind and extent of linkages among the researchers, extensionists and farmers was prepared. Also a list of linkage mechanisms existing in the above mentioned areas where the three stakeholders could participate with each other was prepared. The respondents were asked to give their response on a three point continuum of always, sometimes and never and a score of 3, 2 and 1 was given to these responses respectively. An overall mean score for each respondent was calculated based on their response for each statement in the interview schedule. The data was analyzed using mean scores, cumulative cube root method and ranking.

Results

Kind and extent of research-extension linkages

While interacting with the respondents during the data collection, it was found that all the respondents had formal linkages with each other and informal linkages with the farmers.

The data presented in Table 1 showed the extent of linkages perceived by the ADOs, PAU extension specialists, researchers and KVK Subject Matter Specialists (SMS) with each other and with the farmers. As evident from Table 1, majority of the ADOs had no linkages with the PAU extension specialists (65.6%) and researchers (84.4%) while 87.5 per cent of them had weak linkages with KVK SMS. Majority of the ADOs i.e. 78.1 per cent had medium linkages with the farmers while only 21.9 per cent of them had strong linkages with the farmers. These findings are in line with the findings of Surendran (1982) and Jaiswal and Das (1981). On the basis of mean scores of the ADOs on their extent of linkages, it was found that farmers were on first rank with a mean score of 3.22 followed by KVK SMS with a mean score of 2.13 while researchers at last rank with a mean score of 1.16. The data revealed that majority of the KVK SMS i.e. 86.7 per cent had medium linkages with PAU extension specialists while 60 per cent and 80 per cent of them had weak linkages with researchers and ADOs respectively. KVK SMS (80%) had medium linkages with the farmers while 13.3 per cent of them had weak linkages with them. On the basis of mean scores of the KVK SMS on their extent of linkages, farmers were on rank first with mean score of 2.93 while PAU extension specialists were placed at second rank (2.87) and ADOs were placed at last rank with a mean score of 2.07.

The data in Table 1 clearly indicated that a little less than half of the of the PAU extension specialists (47.6%) had medium linkages with the KVK SMS while almost 48 per cent had strong linkages with the researchers. About 57 per cent of PAU extension specialists perceived medium linkages with the ADOs. More than 50.0 per cent of the PAU extension specialists had strong linkages with the farmers while 33.3 per cent had medium linkages with them. On the basis of mean scores of the PAU extension specialists on their extent of linkages, it was found that farmers were placed on first rank with a mean score of 2.76 followed by researchers at rank two (3.33) and ADOs at last rank with a mean score of 2.52. The extent of linkage as perceived by 37.8 per cent of the researchers was strong with PAU extension specialists while 41.5 per cent and 45.1 per cent had medium linkages with KVK SMS and ADOs respectively. Majority of the researchers i.e. 68.3 per cent had medium linkages with farmers. On the basis of mean scores of the researchers on their extent of linkages, PAU extension specialists were placed on first rank with a mean score of 3.04 followed by farmers (2.95) while ADOS at last rank with a mean score of 2.30. These findings are supported by Bourgeois (1990).

Table 1: Extent of linkages as perceived by KVK SMS, ADOs, researchers and PAU Extension Specialists amongst each other and with the farmers.

S. No.	Personnel	Extent of linkage								Mean score	Rank
		NE		W		M		S			
		F	%	F	%	F	%	F	%		
ADOs											
1.	PAU Ext. Splst.	21	65.6	11	34.4	0	0	0	0	1.34	3
2.	Researchers	27	84.4	5	15.6	0	0	0	0	1.16	4

3.	KVK SMS	0	0	28	87.5	4	12.5	0	0	2.13	2
4.	Farmers	0	0	0	0	25	78.1	7	21.9	3.22	1
KVK SMS											
1.	PAU Extn. Splst.	0	0	2	13.3	13	86.7	0	0	2.87	2
2.	Researchers	0	0	9	60.0	5	33.3	1	6.7	2.47	3
3.	ADOs	1	6.7	12	80.0	2	13.3	0	0	2.07	4
4.	Farmers	0	0	2	13.3	12	80.0	1	6.7	2.93	1
PAU Extension Specialists											
1.	KVK SMS	0	0	8	38.1	10	47.6	3	14.3	2.76	3
2.	Researchers	0	0	3	14.3	8	38.1	10	47.6	3.33	2
3.	ADOs	1	4.8	8	38.1	12	57.1	0	0	2.52	4
4.	Farmers	0	0	3	14.3	7	33.3	11	52.4	3.38	1
Researchers											
1.	PAU Extn. Splst.	6	7.3	16	19.5	29	35.4	31	37.8	3.04	1
2.	KVK SMS	7	8.5	32	39.0	34	41.5	9	11.0	2.55	3
3.	ADOs	14	17.1	30	36.6	37	45.1	1	1.2	2.30	4
4.	Farmers	2	2.4	12	14.6	56	68.3	12	14.6	2.95	2

NE: Non-existent; W: Weak; M: Moderate; S: Strong;

Extent of participation of the researchers and extensionists in various linkage mechanisms with each other.

The information regarding extent of participation in linkage mechanisms of researchers and extensionists based on six areas is presented in Table 2.

The extent of participation of the researchers and extensionists in various linkage mechanisms with each other were classified on the basis of their total scores into three categories of low (18-26), medium (26-35) and high (35-46) (Table 2). All the ADOs and KVK SMS perceived a low extent of participation while a little less than half of the PAU extension specialists and 57.3 per cent of the researchers were in the medium category of participation in various linkage mechanisms with each other. Overall, 43.3 per cent of the respondents perceived that their participation in various linkage mechanisms amongst each other was low and only 18.7 per cent of them perceived a high extent of participation in the linkage mechanisms.

Table 2: Extent of participation of researchers and extensionists in various linkage mechanisms with each other.

Category	**ADOs (32)**		**KVK SMS (15)**		**PAU Ext. Splst. (21)**		**Researchers (82)**		**Total (150)**	
Score Range	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**(%)**	**F**	**(%)**
Low (18-26)	32	100	15	100	3	14.3	15	18.3	65	43.3
Medium (26-35)	0	0	0	0	10	47.6	47	57.3	57	38.0
High (35-46)	0	0	0	0	8	38.1	20	24.4	28	18.7

Extent of participation of the researchers and extensionists in various linkage mechanisms with farmers

The extent of participation of the researchers and extensionists in various linkage mechanisms with the farmers were classified on the basis of the total scores into three categories of low (18-25), medium (25-32) and high (32-43) (Table 3). A little less than half of the ADOs (46.9%) and 56.1 per cent of the researchers perceived that they had low extent of participation in the linkage mechanisms with farmers. Regarding KVK SMS and PAU extension specialists, 73.3 per cent and 52.4 per cent of them perceived a medium extent of participation respectively while only 26.7 per cent and 38.1 per cent had high extent of participation in the linkage mechanisms with farmers. On the whole 45.3 per cent of the respondents perceived a medium extent of participation and 42 per cent of them perceived a low extent of participation while only 12.7 per cent of them said that they had high extent of participation in the linkage mechanisms with farmers.

Table 3: Extent of participation of researchers and extensionists in various linkage mechanisms with farmers

Category / Score Range	ADOs (32)		KVK SMS (15)		PAU Ext. Splst. (21)		Researchers (82)		Total (150)	
	F	%	F	%	F	%	F	(%)	F	(%)
Low (18-25)	15	46.9	0	0	2	9.5	46	56.1	63	42.0
Medium (25-32)	11	34.4	11	73.3	11	52.4	35	42.7	68	45.3
High (32-43)	6	18.7	4	26.7	8	38.1	1	1.2	19	12.7

Rank order of linkage mechanism areas based on the extent of participation of the researchers and extensionists with each other

The six linkage mechanism areas were ranked on the basis of overall mean scores of the researchers and extensionists in terms of extent of their participation with each other and the same has been presented in Table 4. The area of capacity building was placed at first rank by ADOs and PAU extension specialists with a mean score of 1.47 and 3.07 respectively while it was given second rank by KVK SMS and researchers with a mean score of 1.47 and 1.76 respectively. Interaction and communication area was placed at first rank by KVK SMS and researchers with a mean score of 2.22 and 1.88 respectively while it was placed at second rank by ADOs and PAU extension specialists with a mean score of 1.18 and 2.2 respectively. Linkage mechanisms in the area of planning and designing was placed at last rank by PAU extension specialists with a mean score of 1.52 while the decision making area was assigned last rank by KVK SMS with a mean score of 1.00. The areas of monitoring and evaluation and decision making were placed at last rank by ADOs (mean score 1.00) and researchers (mean score 1.28). The results are in conformity with the results of Eponou (1993).

Table 4: Rank order of linkage mechanism areas according to the extent of participation between researchers and extensionists

S. No	Areas	ADOs (32)		KVK SMS (15)		PAU Ext. Splst. (21)		Researchers (82)	
		MS	R	MS	R	MS	R	MS	R
1.	Planning and designing	1.05	4	1.22	4	1.52	6	1.41	3.5
2.	Execution and dissemination	1.08	3	1.17	5	1.91	4	1.41	3.5
3.	Capacity building	1.47	1	1.47	2	3.07	1	1.76	2
4.	Monitoring and evaluation	1.00	5.5	1.23	3	1.84	5	1.28	5.5
5.	Interaction and communication	1.18	2	2.22	1	2.8	2	1.88	1
6.	Decision making	1.00	5.5	1.00	6	2.00	3	1.28	5.5

Rank order of linkage mechanism areas based on the extent of participation of the researchers and extensionists with farmers

The six linkage mechanism areas were ranked on the basis of overall mean scores of the researchers and extensionists in terms of extent of their participation with the farmers. A close look at the data presented in Table 5 indicated that the area of capacity building was placed at first rank by KVK SMS and researchers with a mean score of 2.73 and 1.82 respectively while it was given second rank by ADOs (mean score 1.38). Capacity building was placed at third rank by PAU extension specialists with a mean score of 1.80 who assigned first rank to the area of interaction and communication with a mean score of 2.18 while it attained second rank by KVK SMS (mean score 1.66) and researchers (mean score 1.57) and third rank by ADOs (mean score 1.33). Regarding the linkage mechanisms in the area of planning and designing, it was placed at third rank by KVK SMS and sixth rank by PAU extension specialists with a mean score of 1.39 and 1.25 respectively while it attained fourth rank by both the ADOs and researchers with a mean score of 1.21 and 1.29 respectively. Linkage mechanisms in the area of execution and dissemination were placed at first rank by ADOs (mean score 1.43), second rank by PAU extension specialists (mean score 1.84), third rank by researchers (mean score 1.35) and fourth rank by KVK SMS (mean score 1.2). The area of monitoring and evaluation attained fourth rank by PAU extension specialists with a mean score of 1.6 while the researchers ranked it at fifth place with a mean score of 1.12. Both the ADOS and KVK SMS placed the linkage mechanisms of monitoring and evaluation at sixth place with a mean score of 0.52 and 1.13 respectively. The decision making area was assigned fifth rank by ADOS (mean score 1.19), KVK SMS (mean score 1.18) and PAU extension specialists (mean score 1.44) while the researchers placed it at rank sixth with a mean score of 1.00.

Table 5.22: Rank order of linkage mechanism areas according to the extent of participation of researchers and extensionists with farmers

S. No.	Areas	ADOs (32)		KVK SMS (15)		PAU Ext. Splst. (21)		Researchers (82)	
		Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank
1.	Planning and designing	1.21	4	1.39	3	1.25	6	1.29	4
2.	Execution and dissemination	1.43	1	1.2	4	1.84	2	1.35	3
3.	Capacity building	1.38	2	2.73	1	1.80	3	1.82	1
4.	Monitoring and evaluation	0.52	6	1.13	6	1.6	4	1.12	5
5.	Interaction and communication	1.33	3	1.66	2	2.18	1	1.57	2
6.	Decision making	1.19	5	1.18	5	1.44	5	1.00	6

Discussion

A critical look at the results indicate that researchers and extensionists perceived low to medium linkages amongst each other. The discussion with them during the course of study revealed that ADOs and KVK SMS being at the district level had somewhat better linkage amongst each other in comparison to their linkage with researchers and extensionists at PAU headquarters. It was also observed that difference in the institutional setting and physical locations also affected the linkages amongst researchers and extensionists as in case of researchers and extension specialists from PAU and ADOs from the State Deapartment of Agriculture, Punjab. These personnel belong to two different organizations working to achieve the same goal i.e. development of agriculture

and farmers of Punjab, still, lowest linkages were observed among them. In fact, majority of the ADOs perceived no linkages with them.

During the investigation it was revealed that for ADOs linkage mechanisms with researchers and PAU extension specialists were generally the training programmes organized by PAU and district training camps organized by State Department of Agriculture. PAU conducts Adaptive Research Trials (ARTs) for various technologies before their release, to see the adaptation of these technologies in different regions. It was found during the discussion series held with researchers and extensionists that researchers whose technologies were taken up for these trials were not involved in their conduct, monitoring and evaluation. Also, very few ADOs and farmers were involved in the conduct of these ARTs and these were generally managed by PAU extension specialists and KVK SMS. The study also revealed that these ARTs were generally conducted on KVK campus and those conducted at farmers' field were also extension managed trials while farmers had a negligible role of giving their land for these trials. Also, the discussions exposed that almost same farmers were selected for conducting the ARTs year after year. This kind of biasedness also hampered the linkages of extensionists with a large section of farmers who were ignored in such linkage mechanisms. Regarding the linkage mechanisms between ADOs and KVK SMS, in-service training programmes conducted by KVKs, training programmes conducted under Agriculture Technology Management Agency (ATMA) scheme by the concerned ADOs and pest surveillance meetings are few of the programmes where they are linked up with each other. The investigation revealed that ADOs were not participating in one of the regular linkage mechanism i.e. Research Extension Specialists workshops conducted twice a year in PAU. These workshops are a platform where personnel from State Department of Agriculture and PAU researchers and extensionists sit together and review the research and extension system in agriculture sector of Punjab but the irony is that the grass root level extension personnel i.e. ADOs are not a part of these workshops who can provide first hand feedback to the researchers regarding the farmers' perception on their technologies and vice versa.

Linkage mechanisms among researchers and extensionists were found to be confined to their capacity building and communication regarding new technologies and other agriculture related issues. Research and extension were least linked in the planning, execution, monitoring and evaluation of research and extension activities. In fact, it was observed that negligible linkage mechanisms existed pertaining to these areas. It was observed that extension activities like *Kisan Melas*, training programmes for farmers etc. are often separately organized by PAU extensionists and ADOs. This creates confusion among the farmers. Duplicity of extension activities at the same place led to wastage of financial resources, manpower and time.

It was found during the conduct of this study that the researchers and extensionists are generally linking up with farmers for their capacity building and consultation to them on agricultural issues. Very few farmers are involved in planning, execution, monitoring and evaluation of research and extension activities. The farmers also have minimal participation in the linkage mechanisms pertaining to planning, execution, monitoring and evaluation of research and extension activities. This showed that the farmers hardly played any role in planning of research priorities, monitoring and evaluation of technologies and decision making in practical suitability of these technologies to them.

Conclusion

The conventional argument for linkages is that by working together these actors stand better chances for establishing the institutional relationships that can facilitate access to technology, information, capital and marketing arrangements which can in turn enable the farmers to be competitive. The results of the study revealed that the linkages among the three stakeholders were not strong enough and their participation in the existing linkage mechanisms was also less leading to adoption gaps in the recommendations on various technologies.

Thus, the need for effective linkages among research, extension and farmers is essential for development and dissemination of appropriate and location specific farm technologies so as to increase their adoption rate at farmers' level under actual farming conditions.

RECOMMENDATIONS

Strengthening research-extension-farmer linkages

1. Participatory technology generation approach should be used to enhance the participation of farmers in research. In this approach, feedback of the farmers regarding the new technology during the testing stage at research stations, KVKs or at the sites where trials have been conducted should be taken in different districts. This will help the researchers to get adequate feedback directly from the farmers prior to the release of varieties or technology generation.
2. The Performa for the release of new technology should include additional information regarding the feedback given by the farmers during their visits to these trials. This will strengthen the suitability of the

technology to the farmers and will also enhance the research-extension-farmer linkages. It will also lead to higher adoption of technology among the farmers.

3. Participatory technology generation approach should not be confined to the progressive farmers. Rather there should be an adequate representation of all sections of the farmers i.e. small and marginal, medium and large. Also ARTs should not be confined to few selected farmers; rather different farmers should be selected for conducting ARTs every year. This will increase the linkages of the researchers, extensionists and farmers and will also increase the authenticity of these trials.
4. Participatory conduct, monitoring and evaluation should be carried out for Adaptive Research Trials. The concerned researchers should at least be a part of this planning and monitoring team as this forms the basis of generation of new technology.
5. Researchers should be accountable for the adoption of their released technologies or recommendations i.e. the extent of adoption of technologies/recommendations should be reflected into the recommendations credited in the bio-data of researchers. This will increase the release of need based technologies with visible impacts and increase research-farmer linkages.
6. Farmer representation in setting research priorities for different areas in different crops and other agricultural issues may also strengthen research-farmer linkages. This can be enhanced by forming farmers' organizations at district level. Researchers should also be encouraged to participate in the field days conducted on Front Line Demonstrations (FLDs) for different technologies and get first hand feedback of farmers on the technology being popularized. This will also help them to be a part of the dissemination process.
7. The ADOs should also be given an opportunity to participate in the Research-Extension Specialist workshops for *Rabi* and *Kharif* crops conducted twice a year in PAU. If it is not feasible to invite all the ADOS in every workshop, then their participation can be encouraged alternatively. This will help the researchers to get directly linked with the grass root extension workers of the State Department of Agriculture and get first hand feedback.
8. Till now more emphasis is given on individual contacts and mass approach for conducting extension activities. Group approach can prove to be the best approach for reaching the unreached section of the farming community. This includes *Kisan goshtis* (Farmer discussion meetings), short duration training programmes, awareness campaigns and field days at village level. Thus more emphasis should be given on creating awareness to this section of the farmers regarding the PAU mandates and research and extension activities.
9. Participatory monitoring and evaluation of the extension programmes should be made mandatory to avoid wastage of resources and manpower. The number of capacity building/ training programmes and FLDs conducted in KVKs should be reduced and more emphasis should be given on the impact of these extension activities. The short duration training programmes should be carried out off-campus and the impact of the vocational training programmes should be carried out to ensure that these are need based. Also, rather than focusing on the high targets, it is worthwhile to carry out need based programmes with visible impacts. For this, cluster approach can be followed by the KVKs in collaboration with ADOs and farmers. As per the problems of the clusters, extension activities can be planned, conducted and evaluated for their impact. This will increase the authenticity of the extension programmes as well as the extensionists among the farmers.

Suggested model for strengthening research-extension-farmer linkages.

On the basis of the observations made during the study, interaction with the respondents and suggestions given by them a model has been suggested to strengthen the research-extension-farmer linkages.

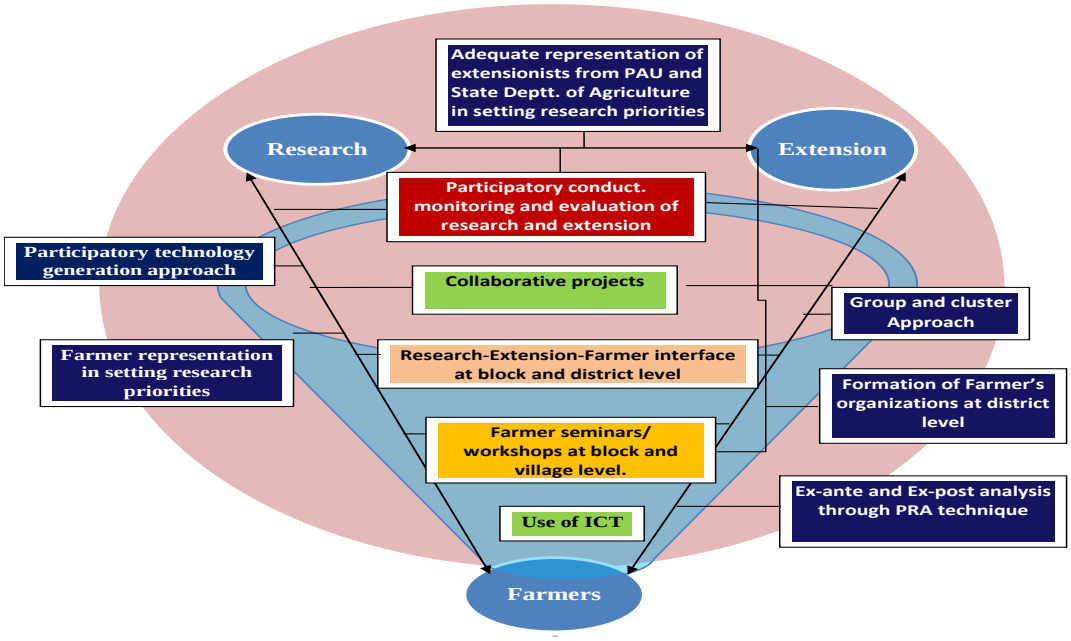

Fig. An operational model for strengthening Research-Extension-Farmer linkages

References

Allen RK (1977) Organisational management through communication. Harper and Row, New York. pp. 75-78.

Anonymous (1992) *Agenda notes for National seminar on agricultural extension.* p. 30. Directorate of Extension, Ministry of Agriculture, Dept. of Agriculture and Cooperation, Government of India, New Delhi, India.

Arnon I (1989) *Organisisng and administration of agricultural research.* Elsevier Publishers Ltd. Amsterdam. In Shekara PC (ed) *Private extension: Indian experiences*. (Original not seen. Cited by Sabarathnam VE (2000) Actual and desired linkages among the various sub-systems of agriculture. Pp 187-99. MANAGE, Hyderabad, India.)

Ashraf I, Muhammad S and Chaudhary KM (2007) Effect of decentralization on linkage among research, extension and farming community. *Pak. J.Agric. Sci.***44:** 660-63. (Original not seen. Cited by Eneyew A (2013) united efforts: The challenge for improved research, extension and education linkages. *Academic Journals.* **8:** 792-99).

Axinn GH and Thorat S (1972) *Modernizing world agriculture-A comparative study of agricultural extension systems.* pp. 112-113. Oxford and IBH Publishing Co., New Delhi, India.

Asopa VN and Beye G (1997) *Management of agricultural research: A training manual. Module 8:Research-extension linkage*. FAO - Food and Agriculture Organization of the United Nations, Rome.

Bourgeois R (1990) Structural linkages of integrating agricultural research and extension: Working paper No.35. p. 22. The Hague ISNAR (Original not seen. Cited by Elfaki MH (2002) The effect of research-extension and farmer linkage on development, adoption and diffusion of agricultural technologies. Proc. *AGREX08.* pp 1-11.Universiti Putra, Malaysia.)

Chahal SS [a], Singh R, China JS, Dhaliwal NS, Singh M, Romana GS, Sodhi GK and Singh N (2009) Paddy cultivation in Punjab: Prospects and constraints. Department of Economics and Sociology, PAU, Ludhiana, India.

Chahal SS $_b$, Singh R, China JS, Dhaliwal NS, Singh M, Romana GS, Sodhi GK and Singh N (2009) Cultivation of wheat in Punjab: Prospects and constraints. Department of Economics and Sociology, PAU, Ludhiana, India.

Chahal SS$_c$, Singh R, China JS, Dhaliwal NS, Singh M, Romana GS, Sodhi GK and Singh N (2009) Cotton cultivation in Punjab: Prospects and constraints. Department of Economics and Sociology, PAU, Ludhiana, India.

Chaudhary S, Clause M H, Clause R And Guntuku D (2011) Extension 3.0: The Use Of Mobile Phones To Design Farmer-Centered Extension Services. http://extensionconference2011.cta.int/sites/default/files/Extension%20Conference_Abstracts_Tools.pdf. Retrieved on 15.11.2013

Crowder L V and Anderson T (1997) Linking research, extension and education: Why is the problem so persistent and pervasive? *J Agric Edu Ext.* **3**: 241-49.

Eponou T (1993) Integrating agricultural research and technology transfer. *Pub. Admn and Dev.* **13:** 307-318.

FAO (2004) FAO/GTZ workshop: "Effective communication between agricultural research, extension and farmers" Research Centre of Agriculture and Forestry Laimburg. 18-22 October 2004, Ora, Italy. (Original not seen. Cited by Eneyew A (2013) United efforts: The challenge for improved research, extension and education linkages. *Academic Journals.* **8:** 792-99).

Havelock RG (1986) Linkage: A key to understanding the knowledge system. In Beal GM, Dissanayake W and Konoshima S (eds) Knowledge generation, exchange and utilization. (Original not seen. Cited by Agbamu JU (2000) Agricultural research-extension linkage systems: An international perspective. *Agric Res Ext Network.* **106**: 7).

Havelock RG, Guskin A, Frohman M, Havelock M, Hill M and Huber J (1971) *Planning for innovation.* Institute for Social Research, Michigan State University, USA, pp. 121-125. (Original not seen. Cited by Gupta V (2000) *A study on the nature and extent of linkages between the scientists of University of Agricultural Sciences, Dharwad and extension personnel of Karnataka State Department of Agriculture in Northern Karnataka.* Ph.D. Dissertation, University of Agricultural Sciences, Bangalore, India.)

Intodia S L (1998) *Identification of technological constraints and action therof in crop production in different agro climatic zones of Rajasthan.* Pp 110. Directorate of Extension Education, Rajasthan Agricultural University, Udaipur. (Original not seen. Cited by Rathore S (2000) Analysis of research-extension-farmer linkage in the Arid zone of India. *Ind. Res. J. Ext. Edu.* **8:** 69-72).

Jaiswal NK and Das PK (1981) Transfer of technology in rice farming. *Rural Dev Digest*, **4**: 320-53.

Kaimowitz D (1989) *Linking research and technology transfer in the development of improved coffee technologies in Colombia*. Staff Note No. 89-54. The Hague: ISNAR, Netherlands

Kohli DS and Singh N (1995) The Green Revolution in Punjab, India: The Economics of Technological Change. Proc. *Conference on Agriculture of the Punjab*. The Southern Asian Institute, Columbia University.

Kunju OAR (1992) *Transfer of agricultural technology: Structural and functional linkages: A study of improved rice varieties.* p. 192. Concept publishing company, New Delhi, India.

Newman B (2007) A bitter harvest: Farmer suicide and the unforeseen social, environmental and economic impacts of the Green Revolution in Punjab, India**.** p.2. Development Report No. 15. Food First, Institute for Food and Development Policy, USA.

Prasad VL and Reddy TJ (1986) Farming system research for livestock development. *J Rural Dev.* **5**: 645-53.

Preet J. (2006) Agrarian Crisis In Punjab: Groping In Dark. *Countercurrents.org, a Newsletter*. March 31, 2006

Rathore S (2000) Analysis of research-extension-farmer linkage in the Arid zone of India. *Ind. Res. J. Ext. Edu.* **8:** 69-72

Rehiman A, Tampi O and Bhaskaran (1991) Transfer of technology system–Functional linkages between and among farm sub-systems. *J. Ext. Syst.* **7**: 91-96.

Roling N (1989) *The agricultural research-technology transfer interface: A knowledge systems perspective.* Linkages Theme Paper No. 6. The Hague: ISNAR, Netherlands.

Sabarathnam VE (2000) Actual and desired linkages among the various sub-systems of agriculture. In Shekara PC (ed) *Private Extension: Indian Experiences*. Pp 187-99. MANAGE, Hyderabad, India.

Sen D (1984) *Changing perspective in extension: Some relevant issues*. pp. 73-74. NIRD, Hyderabad, India.

Sidhu PK and Khera R (2007) Modes of Education at Punjab Agricultural University, Ludhiana, India. Proc *Indo-US Workshop on Innovative E-technologies for Distance Education and Extension/Outreach for Efficient Water Management.* ICRISAT, Patancheru/Hyderabad, Andhra Pradesh, India.

Singh KN (1984) *Developing linkages between research, extension and farmers: Changing perspectives in extension (Mimeo)*. p. 114. NIRD, Hyderabad, India.

Sinha BP (1996) ICAR and SAU's extension system in changing agricultural scenario. *Proc. National Seminar on Extension strategy in the context of globalization of agriculture,* Bangalore, India.

Smith O, Avila M and Abdi N (2004) Strengthening linkages between farmers organizations and agricultural research institutions. *Proc 36th World Farmers Congress IFAP*. pp 1-11. Washington D C USA.

Surendran G (1982) Impact of operational research project on agricultural production. *M.Sc. Thesis, Department of Agricultural Extension*, College of Agriculture, Vellayani, Kerala, India.

Swanson B E (1997) Strengthening research extension farmer linkages. In Swanson BE, Bentz RP and Sofranko AJ (eds) *Improving agricultural extension: A reference manual.* pp 171-78. Food and Agricultural Organization of the United Nations, Rome, Italy.

Thomas B (2012) An Assessment of the Role of Research and Extension Services for Small-scale Crop Farmers in North-Central Namibia. *J. Agric. Biodiv. Res.* **1:** 122-26. Available Online at http://www.onlineresearchjournals.org/JABR

http://www.indianjournals.com/ijor.aspx?target=publisher&type=172 Punjab Agricultural University- Ici (IPs Last access 23-Aug-2013 11:09)

www. pau.edu