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## **An innovative approach of public and private extension services regarding diffusion and adoption of agricultural technology in Balochistan, Pakistan: A conceptual framework**

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### Abstract

*Present research was aim to attempt the perceptions paradigm and adoption of agricultural technology in the province of Balochistan, Pakistan. Five districts were selected purposively namely Quetta, KillaSaifullah, Jaffarabad, Lasbela and Kalat. A sample of 375 farmers and one hundred thirty (130) public and private Extension Field Staff (EFS) was taken by using systematic sampling technique. The results reveals that 32.58% of the farmers fall in the age category of 51 and above followed by the age group of 31 to 40 (25.80%). Large number of public EFS falls in the age category of 31 to 40 years (40.02%). Fellow farmers (4.12), private extension worker (3.73) and public extension worker (3.37) were ranked 1st, 2nd and 3rd respectively. The findings of this study open a new window for future researchers about strategic planning and institutional analyzing. Additional research about public-private-partnerships beyond the range of this study is recommended. Diffusion and adoption of improved agriculture are the tasks of agricultural extension, it is therefore suggested that the public and private services should be focused to small farmers needs and problems. The public-private-partnerships are the mainly crucial in the process of generating and transmitting new technologies to farmers and in achieving the overall joint objective of enhancing crop production.*

**Keywords:** *Adoption; Agricultural Technology; Balochistan; Perceptions; Innovative Approach*

## 1. Introduction

Notwithstanding its fertile land paramount irrigation system and unique climatically condition, agriculture is the life line and backbone of Pakistan economy (GoP, 2015). Agriculture sector is not only the significant source of overseas exchange earnings in the course of exports of agriculture-based products but is also source of income. Approximately 70% of rural populace directly and indirectly related to agriculture and other associated agriculture activities (GoP, 2011). There exists colossal gap between the ordinary and potential yields of major crops and per hectare yield is low as compared to other developing countries (Jalvi, 1996; Khan, 1997). Agriculture in Pakistan undergo from low down intensity of productivity and inadequate management. The squat production is due to conventional method of farming, ineffective extension services and lack of awareness of modern technology and so on. In this scenario, the responsibility of agricultural extension is incredibly part and parcel to propagate the state-of-the-art agricultural technologies and to educate the farmers in order to adopt modern agriculture innovation (Khan, 2003). Globally, the agriculture extension has met structural issues such as accountability, technical relevancy, the lack of a constituency and quality (GoP, 2008).

In Pakistan, numbers of public extension approaches and models have been tried and discarded based on the traditional linear approach. Mostly multi-sectoral extension programs were focused the rural and community development. Village Agriculture Industrial Development Program (V-AID) was leading and major effort for the rural improvement in Pakistan, and planned to resolve rustic level difficulties by way of deployment of the government operational funds/ resources with involvement of rural community (Mallah, 1993). The Integrated Rural Development Program (IRDP), Inputs at Farmers' Doorsteps Approach, People's Works Program (PWP), Training & Visit system (T&V) and Farmer Field School (FFS) were major agricultural extension and community development programs introduced in Pakistan (Davidson et al., 2001; Abbas et al., 2009). Largely the goals of entire multi-sectoral programs were the enrichment of material and social welfare of rural masses (Mallah, 1993; World Bank, 2003). Nearly all were doomed owing to bureaucratic snag, insufficient support services and fragile institutional relationships (Röling, and De Jong, 1998; Davidson et al., 2001; World Bank, 2003; Khan, 2006; Abbas et al., 2009; Ali, 2009; Haq, 2009; Ali et al., 2014). To address these issues, the worldwide agencies and organizations have advised to Pakistani government for major structural changes and yardstick institutional reforms in current extension system so as to enable and strengthen the current extension system appropriate and efficient worth (Rivera, 2001; Khan, 2006). In this connection, Pakistani government is considering for a suitable alternative extension system which is responsive to grower's needs and is cost-effective, sustainable, environmentally safe and sound (Davidson et al., 2001). The public agriculture extension sector has also replaced the prevailing supply-oriented distribution structure with demand-oriented structure in order to confirm the dynamic involvement of indigenous communities in to the decision making practice. It also propagates innovative know-hows amongst the farming communities by utmost actual mode in an attempt to encourage the holistic approaches. It is therefore dire need of the time that agriculture extension services are designed in new prototype with the light of rural socio-

economic characteristics of growers, accessible qualified and skilled human resources (Khushk and Memon, 2004; Khan, 2006).

Balochistan is the slightest developed and most backward province with poor infrastructure, lack of a feasible road network and lack of liaison between agriculture research, extension services and farmers (GoB and IUCN, 2000). The federal and provincial agriculture departments carry out basic agricultural research in Balochistan. The provincial agriculture department is responsible for support and conduct agricultural research. Likewise other provinces of country the organizational structure of agriculture extension services in Balochistan is based on a conventional top-down approach (Mengal et al., 2014). Agricultural Extension Wing supervises district level extension activities through the Executive District Officers (EDOs). T&V system of agricultural extension package was launched in the nineteen eighty four (1984) in pilot basis in the 4 selected districts of Balochistan; namely, Lasbela, JhalMagsi, Loralai, and Nasirabad districts, through the economic support of the World Bank. This program was aimed to increase farm production and the rural income (GoB and IUCN, 2000). However, the current agricultural extension services did not meet the needs of responsive farmers because of lack of trained extension field staff and primary focus on resource-rich farmers (Davidson et al., 2001).

## **2. Rationale of the study**

Review indicated that the provincial agricultural research system lacks adequate trained personnel and financial resources (GoB and IUCN, 2000). On the other hands, Agriculture Extension Wing (EFS) did not carry out agricultural extension activities due to lack of operational funds and poor capacity building of extension staff (Ahmad, 2007). The extension agents mostly have a large area of jurisdiction and focus on a small number of large substantial farmers, consequently overlooking the needs of medium-sized farmers. Now questions arises as to how agriculture extension services could be made efficient and what policies/ strategies are to be implemented and supported in order to make extension more effective (Mengal et al., 2014). Therefore, present study was designed in order to denote the perceptions paradigm of the respondents regarding diffusion and adoption of agricultural technology as an innovative approach in Balochistan, the province of Pakistan.

## **3. Conceptual framework**

Rate of adoption is firmied by numerous reasons. Conferring to Rogers (1995), stated that perceived qualities of an innovation are solitary of the significant descriptions of the rate of adoption of an innovation. From forty nine to eighty seven percent (49-87%) of the discrepancy in the rate of adoption is explicated by five (5) qualities, which are as below:

### *3.1. Perceived attributes of innovations.*

- (a) Relative advantage.
- (b) Compatibility.

- (c) Complexity.
- (d) Trialability.
- (e) Observability.

Moreover, to these five (5) perceived qualities of an innovation, other parameters as variables also disturb the rate of adoption of an innovation (Rogers, 1995), which are as follows:

Types of innovation-decision.

Nature of communication channels diffusing the innovation at various stages of innovation decision process.

Nature of the social system in which innovation is diffusing.

Extent of change agent's promotion efforts.

(i) Relative advantage:

Relative advantage is the point or step to which a novelty/ innovation is perceived as being enhanced than the impression as idea it surpasses. The point of relative advantage is frequently communicated or articulated as financial viability, social-prestige or additional profits.

(ii) Compatibility:

Compatibility is the point or degree to which an invention is superficial as reliable with the prevailing beliefs, previous practices, and requirements of potential adopters.

Compatibility by means of the beliefs and values:

An innovation's irreconcilability with traditional values can chunk its adoption.

Compatibility with hitherto familiarized concepts as ideas:

Compatibility of an innovation with a preceding idea can either speed up or hinder its rate of adoption.

Naming an innovation:

The term specified to an innovation regularly distresses its perceived compatibility, and as a result its rate of adoption. Now and then a medical, chemical or other technical term is utilized for an invention that derives from chemical or a medical research and development. Regrettably, such terms are not precise evocative to potential adopters, unless they are physician, chemist etc. The term specified to an innovation frequently distresses its perceived compatibility, and consequently its rate of adoption.

(iii) Complexity:

Complexity is the point or degree to which an invention seems as comparatively hard to comprehend and use.

(iv) Trialability:

Trialability is the point or degree to which an invention may be tested on a restricted basis.

(v) Observability:

Observability is the point or degree to which the outcomes of an invention are observable to others.

### 3.2. *Types of innovation decision:*

There are three types of innovation decisions, which are as under:

Optional innovation decisions.

Collective innovation decisions.

Authority innovation decisions.

The descriptions of these three are under:

#### (a) Optional innovation decisions:

The process where adoption of an innovation is an individual phenomenon and decision are optional. These decisions are related to improved varieties of seed, fertilizer, insecticides, preparation of land and associated with irrigation practices. Such decisions are optional for an individual farmer. In case of optional innovation decision, change agent gets easier acceptance in the system.

#### (b) Collective innovation decisions:

Collective innovation decisions are those which individuals in the social system make by consensus. Sometimes the extension workers are reluctant to promote collective innovation, because of the difficulty of getting people together. Collective decision making consists of following sub-process. Collective innovation decisions listed on below:

Stimulation:

Stimulation is the stage at which someone aware that need exists for a certain innovation. Because none of the system's members know about the innovation, the stimulator is very often an outsider to the system, who is oriented to other system.

Initiation:

Roger and shoemaker (1971) stated that, initiation is a sub-process by which the new idea receive increased attention by the members of the social system and further adapted to the needs of the system. The initiator is an insider, a local individual who knows the system.

Legitimation:

Kausar et al., (1982) narrated that; legitimation is an important sub-process of the social system to approve the innovation. Legitimizers play a passive role in which they either approved or discard or suggest modification in the proposal offered to them. The research studies revealed that, despite of maximum stimulation and highly active role of initiator, any disregard for the legitimizer could cause failure in the adoption of collective innovation.

Participants:

It is considered advantageous to have widespread participation of the members of the social system in the action to be taken for adoption of a collective innovation. In spite of the consensus in the decision, the action process itself may not proceed smoothly. Obstacles, such as inter-kin rivalries, unequal benefits and sharing of work always delaying the implementation of the decision (Mirza and Merry, 1979).

(c) Authority innovation decisions:

These are the decisions in which someone of superior power position used his influence and forced other individuals to adopt the innovation. In this case, adopters are not free to exercise their choice; someone of commanding authority in the social system influences them to confirm to the decision. These types of decision normally occur more frequently in formal organizations. It can be structured in a council of elders that have traditionally been transferred from within the system. Once the decision to adopt an innovation is taken, then it can be left optional for the individuals to get benefited from it.

3.3. *Communication channels:*

The communication channels utilized to drawn-out an invention may also effect the innovation's rate of adoption. Channels are the mediums through which innovations are diffused among the member of social groups. The examples of common channels are radio, television, newspapers etc.

3.4. *Nature of social system:*

The nature of community or social structure reflected the pattern of people's interaction. It has a structure, which is determined by the status possessed by its members with their different roles, which are in turn governed by certain norms. Each social system has functions to perform that are the pattern of interaction prevailing in it, are aimed at fulfilling its member's need.

3.5. *Extent of change agent's promotion efforts:*

An innovation or invention rate of adoption is likewise exaggerated by the change agent's efforts. The utmost reply as feedback to change agent determination happens while opinion leader adopts the innovation. After that, innovation then continues to spread with little promotion by change agent.

#### **4. Objectives**

The explicit objectives or purposes of present study were as under:

1. To study the demographic information of the respondents.
2. To determine the sources of information as perceived by the respondents.
3. To develop recommendation for making public and private extension services more need-based and result-oriented.

## 5. Materials and methods

Research design is the inclusive strategy of an investigation (Ray and Sagar, 1999). Descriptive research plays a cardinal role in educational research (Knupfer et al., 2001) and is measured maximum suitable for obtaining people's insight on socio-economic actualities (Cohen et al., 2007). The target population for this study consisted of farmers and both public/ private extension field staff of the five purposively selected districts of Balochistan province namely Quetta, KillaSaifullah, Jaffarabad, Lasbela and Kalat. From the farmers group, a sample of 375 farmers; seventy five (75) farmers from each district were selected. Sample was chosen by using systematic sampling or selection technique whereas each Nth numeral is randomly taken (Gay and Mills, 2006). The sample dimensions for mutually populations were fixed by utilizing Wunsch (1986) table of "Selecting Sample Sizes" at the 0.05 percent error rate. Likert scaling as opinion tools was utilized aimed at measuring of attitude of the respondents (Lindner et al., 2003). However, the response rate was 82.67 (310 farmer respondents out of 375) and 86.15 (112 extension field staff of both sectors out of 130). SPSS (PC) program was used to analysis the data (Boone et al., 2002). Analysis of data was carried out by using frequency distributions, percentages, means, standard deviation and rank orders (Eck and Torres, 1996).

## 6. Results and discussion

Demographic information is pivotal characteristic and plays important role in dissemination of information, particularly in the field of agriculture. These characteristics also influence the attitude of respondents regarding the adoption of innovation (Alene et al., 2005; Chaudhary, 2005; Memon, 2007; Mohamed and Temu, 2008).

The age composition of farmers was divided into five categories. Which showed that 32.58% of the farmers fall in the age category of 51 and above followed by the age group of 31 to 40 (25.80%) (table-1). More than half (53.54%) of the farmers were illiterate and only 1.30% of farmers received above intermediate level education.

The age of extension field staff was grouped into four categories. The data in this respect indicated that a large number of public EFS falls in the age category of 31 to 40 years (40.02%) followed by the age group of 41 to 50 years (31.76%). Only 11.76% of public EFS belonged to 51 and above category. Less than half (44.44%) of the private extension field staff were between 31 to 40 years. While 22.22% were in the age group of 51 and above.

**Table 1: Age and education of farmers (n= 310)**

Demo: profile	Categories	Frequency	%age
Age of respondents	Up to 20	4	01.30
	21 to 30	50	16.12
	31 to 40	80	25.80
	41 to 50	75	24.20
	51 and above	101	32.58
Demo: profile	Categories	F	%age
Educational level	Illiterate	166	53.54
	Up to primary	60	19.35
	Middle	30	09.68
	Matriculation	40	12.90
	Intermediate	10	03.23
	Above intermediate	04	01.30

**Table 2: Age and education of EFS (n= 112)**

Public EFS			Private EFS		
Age	F	%age	Age	F	%age
18 to 30	14	16.46	18 to 30	08	29.63
31 to 40	34	40.02	31 to 40	12	44.44
41 to 50	27	31.76	41 to 50	06	22.22
51 & above	10	11.76	51 & above	01	03.71
Public EFS			Private EFS		
Education	F	%age	Education	F	%age
Matric:	29	34.11	Matric:	01	03.70
Inter:	22	25.88	Inter:	01	03.70
Dip: in agric:	16	18.82	Dip: in agric:	00	00.00
B.Sc.	10	11.77	B.Sc.	17	62.97
M.Sc.	07	08.24	M.Sc.	08	29.63
PhD	01	01.18	PhD	00	00.00

The data in table-2 further shows that most (34.11%) of public EFS holding matriculation followed by 25.88% had completed intermediate education while, 18.82% received a diploma in agriculture from agricultural training institute. Whereas only 1.18% of the respondents among the public (EFS) had doctorate degree (PhD). More than half (62.97%) of the private EFS holding B.Sc. degree followed by 29.63% holding M.Sc. degree in agriculture discipline.

Present study identified effectiveness of various sources of information as perceived by farmers. Table-3 depicts the results.

**Table 3: Sources of information (n= 310)**

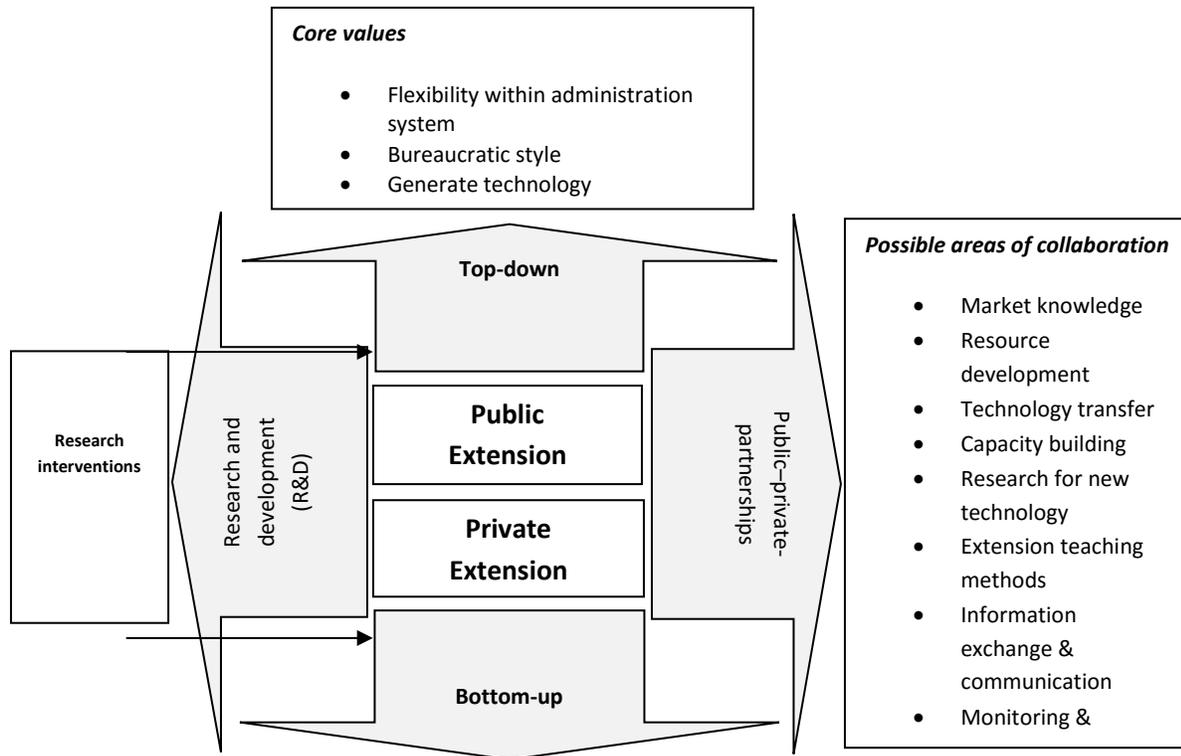
Sources of information	Rating Value										Mean	S.D**	Rank Order
	S D (1)		D (2)		U (3)		A (4)		S A (5)				
	F	%	F	%	F	%	F	%	F	%			
Fellow farmers	4	1.29	12	3.87	5	1.1	210	67.7	79	25.48	4.12	0.72	First
Private EW	9	2.9	40	12.9	11	3.5	216	69.7	34	11.0	3.73	0.92	Second
Public EW	30	9.7	62	20.0	8	2.6	183	59.0	27	8.7	3.37	1.18	Third
Print media	39	12.6	126	40.6	7	2.3	133	42.9	05	1.6	2.80	1.17	Fourth
Radio programs	33	10.6	136	43.9	15	4.8	121	39.0	5	1.6	2.77	1.12	Fifth
Agriculture liter:	44	14.2	125	40.3	10	3.2	126	40.6	5	1.6	2.75	1.17	Sixth
TV programs	38	12.3	143	46.1	18	5.8	108	34.8	3	1.0	2.66	1.10	Seventh

Scale\*: 1= Strongly disagree, 2= Disagree, 3= Undecided, 4= Agree, 5= Strongly agree

SD\*\* = Standard deviation

The rank order was specified on the root of mean so as to observe the comparative position of each category vis-à-vis of various sources of information. Fellow farmers (4.12), private extension worker (3.73) and public extension worker (3.37) were ranked 1st, 2nd and 3rd respectively. While, agriculture literature (2.75) and agriculture programs on television (2.66) were ranked 6th and 7th respectively.

**Fig 1: Technology Transfer Model (TTM)**



Present technology transfer model was designed in order to promote the effective liaison of line-departments i.e. encourage the bottom-up planning, promote the broad-based extension advisory system, exposure visits to farmer thus to fill the knowledge gap and provide a important edge as an advantage for the agriculture extension system (Fig-1). Public sector has wide-ranging physical infrastructure, institutions of advanced or developed learning that can produce knowledge/ information through rudimentary investigation and it has a massive pool of human resource and proficient manpower. On the other hand, the private sector is recognized to have improved marketing services, well-organized invention distribution structure, eminence provision providing ability, excellent managerial resources and superior or state of art know-hows. The strengths of dual sectors are leveraged. In this regard, model recommended public-private-partnership so as to achieve the objective of building human capacity for food and agriculture through trainings. The core of the Technology Transfer Model (TTM) was strengthening the public and private extension collaboration and multi-way cyclical feedback and linkage among farmers, public and private extension. The research activities and inventions of public sector could develop additional values by up-scaling and marketing services of private sector through public-private partnerships. Enhancing outreach and sustained meaningful benefits to farmers can only be ensured through collaborative efforts of public and private initiatives. A participatory approach, farmer-oriented and need based research was

strengthened; in this connection both public and private sectors should be allies cohorts in this effort in order to covering entire production cycle. Public-private-partnership through influential institutional mechanisms as well as combined endeavors would be necessary and suitable to empower the extension system. The model describes how public, private extension services and agriculture research institute can make an active relation through the two-way efforts at the farm level. The public and private extensions have their core values for which they will not compromise for professional collaboration. These values are: 1) bureaucratic style, 2) profit-oriented motives, 3) flexibility and rigidity within administration or system structure. However, both extension systems can possibly collaborate in the areas such as market knowledge, resource development, technology transfer, capacity building, and research for new technology, extension teaching methods, information exchange / communication, monitoring & evaluation. Essential marketing knowledge and information is primarily needed so as to facilitate the farming communities for selling their produce within the time for fetching maximum income of its hard labor. Moreover, there is too need to initiate the interchange of facts and continuous communication between the public and private extension, both of which are necessary for efficient collaboration and monitoring. Enhancement of agricultural growth on the sustainable basis can be achieved through effective technology transfer mechanism, both public and private sectors should make efforts to develop capacity, links and strengthen on exiting sources so as to foster the technology transfer process (Sheikh et al., 2016). The sound growth of food production is connected to advancement in research and development (R&D), which is liable for the incessant development of innovations. Joint collaboration between dynamic and productive system actors about research intervention could be accomplished by mean of public-private-collaboration.

## **7. Conclusions and recommendation**

The conclusions based on the results achieved. In this regard, this portion we placed emphasis to highlights the prominent findings and provides the suitable recommendations regarding the enhancing of the crop production.

### *7.1 Conclusions*

The results reveals that large number of public EFS falls in the age category of 31 to 40 years (40.02%) followed by the age group of 41 to 50 years (31.76%). More than half (62.97%) of the private EFS have holding B.Sc. degree. Fellow farmers (4.12), private extension worker (3.73) and public extension worker (3.37) were ranked 1st, 2nd and 3rd respectively. Public sector has extensive infrastructure, institutions of higher learning that can generate knowledge through basic research and it has a vast pool of human resource and proficient manpower. On the other hand, the private sector is known to have better marketing skills, efficient product delivery system, quality service providing capability, excellent managerial resources and better up-scaling technologies.

## 7.2 Recommendations

Diffusion and adoption of improved agriculture are the tasks of agricultural extension, it is therefore suggested that the public and private services should be focused to small farmers needs and problems. The findings of this study open a new window for future researchers about strategic planning and institutional analyzing. Additional research about public-private-partnerships beyond the range of this study is recommended. The public-private-partnerships are the mainly crucial in the process of generating and transmitting new technologies to farmers and in achieving the overall joint objective of enhancing crop production.

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