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EFFECTIVENESS OF INFORMATION AND COMMUNICATION TECHNOLOGIES AS INFORMATION SOURCE AMONG FARMERS IN PAKISTAN

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This study examined the perceived effectiveness of different information communication technologies (ICTs) as information source among farmers in Punjab province of Pakistan. This study is distinctive in nature as eight ICT tools (Mobile, TV, Radio, Internet, Helpline, Agri. websites , Landline phone and Computer) are compared on 8 characteristics (better agricultural information source, improved farming skills, accuracy of information, effective source of communication, in time sharing of information, cheaper source of information, user friendly and easy access to information. Uses and Gratification theory was theoretical framework and cross-sectional survey-based research design was employed on 400 randomly selected farmers. Data were collected through validated interview schedule and collected data were analyzed using descriptive statistics and cross tab analysis. Results indicate that majority of respondents (90.3%) in the study area were small farmers with 45% literacy rate. About 85.0, 79.8 and 45.8% respondents had mobile, TV and radio in their possession. While, internet, computer and landline phone were in possession of 17.8, 9.3 and 3.8% respondents, respectively. Mobile, TV and Radio were greatly used ICT tools while internet, computer, helpline and landlines were least used. Mobile (M=4.06), TV (M=3.96) and Radio (M=3.96) were perceived effective of almost high level on Likert scale. Other tools including agri. websites, computer, helpline, landlines were comparatively less effective pertinent to high cost, accessibility and accuracy of information. According to this study presently modern ICTs having ability of effective communication higher than traditional sources. This study recommends that information departments and agricultural directorates should amend contents of modern tools according the needs and socio-economic conditions of farmers for escalated usability.

Keywords: ICT, traditional information sources, information sources, mobile, modern sources.

INTRODUCTION

Economy of Pakistan is profoundly reliant on agriculture sector with 19.5 percent contribution in Gross Domestic Product (GDP), 42.3 percent labour force generation and livelihood support to 60 percent of the population (GOP, 2017). About 53-82% yield gap in Pakistan as compared to other countries was unveiled by Kamal *et al*. (2012). This yield gap is attributed to traditional methods of farming (Ali, 2010), subsistence farming (Sattar, 2012), high cost of production (Khan, 2012), inadequate awareness of modern techniques (Jehangir *et al.,* 2007), poor socio-economic status of farmers (GOP, 2012), imbalance use of inputs (Iqbal and Ahmad, 2005), intensive cultivation (Hussain *et al.,* 2003), diseases infestation (Khan, 2012), injudicious use of pesticides (GOP, 2012), Soil Salinization (Qureshi *et al.,* 2008), water logging (Aslam *et al.,* 2008), climatic variations (Sattar, 2012) and poor educational level (Masood *et al.,* 2012). Major constraint is associated with abilities of farmers which can be improved through advisory services and information dissemination. Regardless of overwhelmed constraints, still agriculture is main source of income among farmers and food production to meet national demand. This can be achieved through an effective mechanism of information sharing among farmers to amend their behavior toward modern, cost saving and highly profitable techniques. Like many other countries of the world, Pakistan also has proactive and fast-growing sector of information communication technologies (ICTs) to facilitate farmers (Shahbaz *et al.,* 2013) In recent years, Pakistan documented a productive pace in building ICT infrastructure, promoting the educational perspectives of ICTs and making the adoption cost effective and affordable. The policies developed by governments were user friendly and favorable to promote innovations among the users. For instance, introduction of mobile internet and enhanced access for the poor to information was major achievement that telecommunication policy exerted.

From two decades mobile telecommunication sector showed exponential growth at global level. This growth of mobile sector had significant influence on human life and fortified the economic development indicators (Kenny and Keremane, 2007). Though, potential of ICTs is partially explored in country, but still, Pakistan is third fastest arising telecom

market around the globe. Pakistan embarked triple digit growth performance till 2007-08; growth was bit slower after then, but, growth enjoyed the heights again in 2010 (PTA, 2010). King *et al.* (1994) stated that diffusion of any innovation or technology primarily depends upon these three factors i.e. consumers pull, service providers push, and both the aspects are tempted by rules set by regulators. The role of Pakistan Telecommunication Authority (PTA) as a regulator has been seen remarkable in keeping the growth goes in better direction. ICTs are facilitative for extension agents to share improved technologies among end users to act upon and get their livelihood uplifted (Chavula, 2014). ICTs enabled farmers to receive updated, authentic, relevant and timely information. ICTs are helping farmers to find suitable and profitable markets for their produce (Azeem and Ali, 2015). The major objective of this study was to assess the effectiveness of different ICT tools being used by the farmers to fetch required information. This research was based in Punjab province of Pakistan. Punjab province is considered as the basket bread of the country as major share of national economy comes from this province. This province is blend of multiple cropping system, schemes and weather patterns which suits cultivation of vast number of major crops.

***Research Question*:** Which information source is more effective in meeting the needs of the farmers? What is the scenario of modern information sources such as web-based services as information source among farmers?

***Theoretical Framework*:** This study was mainly focused on assessment of effectiveness of various ICT tools. Effectiveness is the outcome of use of different ICT tools by the farmers to meet their information needs. This study adopted Uses & Gratification theory as a theoretical framework. This theory was presented by Katz *et al.* (1973). This theory illustrates that how people adopt and utilize different channels to meet definite needs. This idea spreads to business, groups and society as a whole. However, typically this idea encompasses traditional media, while recently the foundations of this theory are being emphasized on various types of modern media. This theory can determine that how respondents and audiences are engrossed to a particular media (Katz *et al.,* 1973) and how targeted respondents could be fortified to adopt emerging channels. The assumptions of theory are closely associated with roadmap of this research study. Major ICT tools, Mobile, Radio, Internet, TV, computer, helpline, website and landlines phone were investigated in this study. However, print media was kept exclusive. In a rural community, farmers not only support their families but also produce food for entire society. Hence they have a distinct position in the society. Therefore, inline to this theory possession of ICT tools, extent of use of these tools and what level of effectiveness they perceived was investigated, which would likely be playing role in meeting their information needs in future.

MATERIALS AND METHODS

This research study was conducted in Punjab province of Pakistan which is known as bread and basket of country. Study entailed cross-sectional, descriptive and survey research design. This research design has already been used in various research studies in Pakistan like (Muhammad (1994), Idrees (2003), Lodhi (2003), Siddiqui (2006) and Khan (2010). Punjab province comprised of 36 districts. Two districts of the Punjab, (i) Rahim Yar Khan and (ii) Muzaffargarh, were selected at random.

Multistage random sampling technique was used to select sample size for this study. On first stage, two tehsils from each district Muzaffargarh (Ali Pur and Muzaffargarh) and Rahim Yar Khan (Khan Pur and Sadiqabad) were selected at random. On next stage five (05) villages from each selected tehsil were selected using random selection technique. Complete list of villages was obtained from revenue department of respective districts. This complete list of villages enabled researcher to undertake random selection of five (05) villages from each selected tehsil. For selection of respondents, a brief benchmark survey was conducted with the help of local leaders, field assistants and some progressive farmers of these areas. This survey resulted a list of 4012 farmers from four (04) selected tehsils. This list of farmers served as sampling frame. Hence, 20 farmers were selected from each selected village through random sample selection technique. Thereby making a sample size of 400 respondents selected by considering the Yamane (1967) formula of sample selection. This formula for sample estimation has been widely used by Hussain and Thapa (2012), Ullah *et al.* (2016) and Zulfiqar and Thapa (2016).

A validated and pre-tested interview schedule was used as data collection tool. A five point Likert scale was used to probe the extent of use of ICT tools and perceived effectiveness of ICT tools. In Likert scale 1 reflected the least while 5 denoted the highest. Collected data were analyzed through Statistical Package for Social Sciences (SPSS). Descriptive statistics (percentage, mean, standard deviation) were applied for the meaningful interpretation of data.

RESULTS AND DISCUSSION

Demographic attributes of the respondents include age of the respondent, education, land holding, tenancy status, cultivated area and sources of information. Demographic attributes have important role in awareness and adoption of modern production practices. Demographic attributes of the respondents also have vital position in modern technologies adoption (Hassan *et al.,* 2005). Detailed description of these attributes is illustrated in Table 1.

Table 1. Demographic attributes of the respondents.

Demographic attributes of the respondents	*f*	%
Age (in years)		
Up to 35	178	44.5
36-50	125	31.2
Above 50	97	24.3
Mean age	41.1 Years	
Educational Level		
Illiterate	180	45.0
Primary	48	12.0
Middle	62	15.5
Matric	63	15.7
Greater than matric	47	11.8
Landholding size		
Small (<12.5	361	90.3
Medium (Above 12.5-25)	33	8.3
Large (>25)	6	1.5
Tenure ship		
Owner	352	88.0
Tenant	12	3.0
Owner-cum tenant	36	9.0
Area under cultivation		
Up to 12.5 acres	381	95.3
>12.5-25	13	3.3
>25	6	1.5
Source of Income		
Farming only	317	79.3
Multiple sources	83	20.7

Data mentioned in Table 1 indicates that about 44% respondents fell in age bracket of up to 35 years. About 31.2% respondents fell into age bracket of 36-50 years. Whereas, one fourth respondents (24.3%) were of more than 50 years age. This implies that among respondents, young age respondents were considerably prominent. This healthy participation of young ones is also a notion towards mainstreaming agriculture across the country. While 55% were literate fall in different categories i.e. primary, middle, martic, intermediate and above intermediate, among these respondents greater than one tenth respondents had highest level of education. While 12% had primary level of education. In the farming activities, engagement of young and educated individual is a positive sign for the profitable farming. This uneven situation of education implies that respondents may not be able to understand the complexities of latest farming technologies, so it may cause the low adoption of technologies. Majority of respondents (90.3%) in the study area were small farmers medium and large farmers was only 8.3 and 1.5%, respectively. Likewise majority of farmers (88%) were owner of their lands. While only 3.0% were tenant and 9.0% were owner-cum tenant in the study area. Being owner makes farmers more innovative and able to take risks for better outcomes. Trend of being tenants and owner-cum-tenant was less in study area. In the study area farming under 12.5 acres was dominant (95.3%) followed by 3.3. and 1.5% respondents who were practicing farming on more than 12.5 acres of land. Hence, across the study area majority of farming communities was relying on farming for income generation (79.3%). These results reflect that farming is baseline for farmers in study area, only 20.7% rely on multiple sources in study area. Regardless of age, education, land size and tenancy type, they are involved in farming to generate income. This involvement in farming urge easy access to information to bridge knowledge gaps among farmers.

Results presented in Table 2 reveals that 85% respondents had mobile phone, 79.8% had TV at their homes while 45.8% had radio in their possession. While internet, computer and fixed phone were only among possession of 17.8, 9.3 and 3.8%, respectively. Hence, mobile phone, TV and radio were leading ICT tools perceived in possession of farmers. Possession of fixed or landline phone was only 3.8%. Slightly less than one tenth respondents had computer followed by 17.8% respondents who had internet facility. Not possessing a computer among 90.8% respondents reflect poor interest of the farmers in this modern technology. During discussion it was unveiled that mobile based internet facility of different cellular companies had initiated different internet services and facilities which were actively being utilized. Regarding possession year TV was oldest found in possession among 11% respondents from more than 10 years. About 6.8% respondents had mobile phone from over 10 years. Possession of various ICT tools ranged between less than 10 years.

Data mentioned in Table 3 resulted that among various ICT

Table 2. Distribution of the respondents according to their possession of ICT tools.

ICTs Tools	Possession				In possession since					
	Yes		No		1-5 years		>5-10 years		> 10 years	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
Radio/ FM	183	45.8	217	54.3	120	30.0	48	12.0	15	3.8
TV	319	79.8	81	20.3	176	44.0	99	24.8	44	11.0
Internet	71	17.8	329	82.3	71	17.8	0	0.0	0	0.0
Computer	37	9.3	363	90.8	31	7.8	6	1.5	0	0.0
Mobile phone & social media	340	85.0	60	15.0	214	53.5	99	24.8	27	6.8
Fixed phone/ land line phone	15	3.8	285	96.3	6	1.5	6	1.5	3	0.7

tools, use of mobile phone was perceived foremost (M=4.61). This mean value implies that extent of mobile use to access information was close to very high level. During informal discussion respondents affirmed that cost, efficiency and user-friendly operating system were the chief supporting factors. Use of TV appeared 2nd prominent (M=3.30) after mobile phone. Difference of extent of use between mobile and TV was wider. The extent of use of TV was slightly greater than medium level. Being cordless and embedded with multiple options mobile was perceived preferred medium as compared to other tools like TV. Usability of radio stood on 3rd rank with mean value of 2.61. However, extent of use of radio was approaching towards medium level. Furthermore, extent of use of other tools like agri. Websites and internet was limited as placed at 4 and 5th ranked by the respondents respectively. Further agri. Helplines, computer and fixed phone were placed at lowest as 6, 7 and 8th rank. These situations highlighted that use of latest ICTs among the farmers were less as compared to the traditional sources.

Table 3. Distribution of the respondents according to the extent of use of ICT tools.

ICTs devices/ tools	Mean±SD	Rank
Mobile Phone	4.61±1.714	1
TV	3.30±1.761	2
Radio/FM	2.61±1.688	3
Agri. Websites	2.44±0.720	4
Internet	2.12±1.206	5
Agri. Helplines	2.00±0.609	6
Computer	1.21±1.036	8
Fixed phone/ land line phone	1.00±0.484	9

***Better agricultural information source*:** Results states that mobile was perceived more effective agricultural information source (M=4.17). Effectiveness of mobile was perceived greater than high level in improving knowledge and farm production. Aldosari *et al.* (2017) and Chhachhar *et al.* (2014) had perceived mobile an effective source. Accessibility of mobile is bridging the information gaps (Otter and Thruvsen, 2014). Radio was perceived closely effective like mobile phone with effectiveness of greater than high level (M=4.11). Another constituent of broadcast media, the TV was also perceived effective however, lower than radio. Effectiveness of TV was slightly closer to high level (M=3.98). Agricultural websites were perceived effective among the respondents (M=3.78) because of its visual contents and facility of copying and downloading the contents. Internet was effective but of greater than medium level followed by helplines exhibiting effectiveness of medium level (M=3.19). Effectiveness of computer and landline phones was perceived less than medium level with mean values of 2.89 and 2.70 respectively. These findings summarize that farmers were more or less inclined towards mobile phone and radio for accessing agricultural information.

***Improving farming skills*:** Availability of information persuade farmers' abilities. Thus, accessing information through mobile phone was perceived highly effective (M=4.12) in improving farming skills. Aldosari *et al.* (2017) stated that accessibility of mobile is up now a day and users felt use of mobile much appreciated and effective. Otter and Thruvsen (2014) found mobile phone effective in increasing crops production due to timely access of information. Easy access to information through mobile was perceived leading reason of effectiveness among farmers (Chhachhar *et al.*, 2014). Effectiveness of other ICT tools was significantly lower than mobile phone. Effectiveness of radio, TV, internet and agri. websites was approximately greater than medium level. TV was reported significantly increasing farmers knowledge through educational interventions (Nazari *et al.*, 2011). Through TV useful messages were broadcasted (Kim, 2010) which in result increasing the farmers awareness and knowledge regarding farming (Nazari *et al.*, 2009). Helplines, computer and landline uses were not much effective, as perceived by the respondents. During informal discussion respondents acclaimed that mobile phone increased their access to information source multifold. Respondents argued that they are now in frequent contact with extension workers to meet their information needs.

***Provide Accurate information*:** According to the farmers they received more accurate information through the mobile phone. This perceived accuracy was of high level (M=4.01). Accuracy of information enabled farmers to effectively execute the information. For instance, Anoop *et al.* (2015) confirmed that accurate information received through mobile helped farmers to avoid monopolies of middleman and effectively market their produce (Lee and Bellemare, 2013). Accuracy of information perceived through other ICT sources was of less than high level. For instance, accuracy of information coming from landlines and helplines was slightly higher than medium level. Farmers said that communicating through mobile with experts raised accuracy of information.

***Effective communication*:** Mobile phone was perceived most effective communication sources with mean value of 4.21. Facility of calling, sharing audio video contents and video calling turned mobile more effective. Respondents further appraised two way communication through mobile phone. Radio was 2nd leading effective source of communication (M=4.05). Computer and landline were perceived least effective source of communication with mean values of 2.90 and 2.68, respectively.

***Provide timely information*:** Respondents found radio prominent in making information available in time. Effectiveness of radio in this regard was highly effective. Radio was perceived as story teller by Fossard (2005) while Mirani *et al.* (2003) unveiled high level of satisfaction of farmers with communication made through radio programs. Radio successfully disseminated useful information on production and protection measures for crop (Khan and

Table 4. Comparative effectiveness of different ICT tools as perceived by respondents.

Effectiveness in regard to	Mobile	TV	Radio	Internet	Computer	Landline	Helpline	Websites
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Better agricultural information source	4.17±0.99	3.98±0.97	4.11±0.82	3.54±1.55	2.89±1.55	2.70±1.54	3.19±1.36	3.78±1.41
Improve farming skills	4.12±0.72	3.65±0.89	3.73±0.99	3.59±1.39	2.66±1.34	2.78±1.36	2.93±1.34	3.56±1.30
Provide accurate information	3.96±0.74	3.88±0.80	4.12±0.91	3.96±1.24	2.66±1.73	3.08±1.15	3.22±1.28	3.49±1.31
Better communication	4.05±0.89	3.81±0.89	4.21±0.82	3.81±1.98	2.90±1.67	2.68±1.25	3.52±1.58	3.36±1.25
Provide timely information	4.32±0.79	3.68±0.85	4.09±0.84	3.94±1.28	2.72±1.22	2.56±1.29	3.09±1.42	3.22±1.27
Cheaper source of information	3.95±0.72	4.28±0.80	3.50±1.16	2.85±1.31	2.86±1.36	2.76±1.02	3.58±1.31	3.14±1.34
Easy to use	3.95±0.61	4.21±1.01	3.79±1.18	2.70±1.30	2.20±0.70	3.07±1.38	3.50±1.18	2.58±0.91
Easy access to information	4.02±0.91	4.22±0.91	4.28±0.74	3.84±1.19	3.00±1.06	3.10±1.34	3.29±1.41	2.65±1.07

Scale: 1 = less effective, 2 = Slight effective, 3 = Neutral, 4 = Effective, 5 = Highly effective

Shabbir, 2000). Mobile phone was ranked 1st in terms of making information available in time (M=4.32). Effectiveness of mobile was also recorded of high level. Other ICT tools were effective medium level regarding making information available in time.

***Cheaper source of information*:** Respondents argued that TV was most effective being cheaper source of information (M=4.28). Respondents elaborated that TV technology has become common and buying TV does not require huge investment. Comparatively, cost of mobile phone particularly smart phone is higher to witness multiple benefits. After TV being cheaper source of information, mobile turned highly effective in accessing information among farmers (M=3.95). Internet, computer and landline were not perceived cheaper source of information among farmers. This implies that using internet, computer and helplines are cost intensive.

***Easy to use*:** TV was perceived more user friendly among farmers as compared to other ICT tools. In the category of user friendly, TV gained high mean value (4.21) followed by the mobile phone with the mean value 3.95. Ekoja (2003) and Sanga *et al.* (2013) mutually inferred that Radio along with TV were the prominent and effective information source because of their easy access and dissemination of information to lager audiences. Nazari and Hasbullah (2009) stated that radio and TV were highly effective tool in disseminating innovations because of their broadcast for every farmer regardless of their age, gender and education. Similarly, respondents arbitrated that making calls, texts, sharing audio visual contents is easy to handle on phone. This easiness persuaded farmers to utilize the potential of mobile phone for information acquisition from different knowledge sources. Radio was perceived 3rd leading ICT tools regarding easiness of use (M=3.79). Use of helpline is associated with making calls, hence was perceived easy to use by respondents (M=3.50). Use of internet, computer, landline and agri. websites was perceived difficult to access and utilize these ICT tools. To utilize full potential of internet, computer and agri. websites users would have to be literate enough. Collaterally, literacy rate in study area is not up to the mark.

***Easy access to information*:** Radio, TV and Mobile were perceived highly effective offering easy access to information with mean values of 4.28, 4.22 and 4.02 respectively. Fixed schedule of agricultural programs on radio and TV were considered as prime reason of easy access and high effectiveness in result. Ekoja (2003) and Sanga *et al.* (2013) affirmed that radio and TV were perceived effective information source among farmers because of easy access and tendency of information dissemination among large group of audiences. Accessing information from agri. websites was least recorded least easy (M=2.65). Accessing information on computer, internet and helplines was easy of medium level. This scenario implies that respondents in study area had knowledge and understanding of using these ICT tools.

This section summarizes that considering all listed characteristics, average effectiveness of Mobile was higher as compared to other ICT tools (M=4.06). This mean value implies that effectiveness of mobile was of high level among farmers. TV and Radio were equally shared 2nd rank with mean value of 3.96 which indicates the effectiveness of almost high level on Likert scale. Average effectiveness of agri. websites was 3rd (M=3.64), internet 4th (M=3.52), helplines 5th (M=3.29), landline 6th (M=2.84) and computer 7th (M=2.73).

Data depicted in Table 5 is the comparison of level of use of different ICT tools and the perceived effectiveness of these tools among farmers. Mobile phone was the 1st ranked in extent of use and perceived effectiveness stood on 1st rank as well with mean value of 4.06. The average mean value of effectiveness is lesser than the extent of use (M=4.61). This implies that there is need to bring some interventions in mobile services to raise the use and effectiveness among farmers. TV was 2nd top used medium and perceived effectiveness of TV obtained 2nd rank with mean value of 3.96. The average mean value is almost equal to effectiveness of high level. Interestingly, effectiveness of TV is perceived greater than the use. This shows the positive impact of TV among farmers in meeting their needs. Radio had 3rd rank in use while perceived effectiveness was ranked 2nd along with TV with mean value of 3.96. Radio embarked a significant

impact among farmers as effectiveness remained higher than the use. Radio is a traditional folk and choice of old age farmers to carry along with and enjoy broadcasting. This implies that lesser cost and easy to handle may be the reason behind effectiveness. The effectiveness of mobile, TV and radio reflects that these mediums were successful in broadcasting better agriculture information, accurate and timely information. Nazari and Hasbullah (2009) stated that radio and TV were highly effective tool in disseminating innovations because of their broadcast for every farmer regardless of their age, gender and education. The information shared was according to the need of farmers. Moreover, lesser cost, easy to use and easy access helped farmers to improve their farming skills through the information delivered via mobile, TV and Radio. Effectiveness of modern tools like agri. websites, internet, helplines, computer and landline was higher than the extent of use. Though, effectiveness was significantly lower than the mobile, TV and Radio. This implies that these modern tools had a potential to become and effective information source. However, there is need to modify them according the needs of farmers. Educational level, cost and authenticity of information are some considerable challenges needs to be removed. Regarding computer and internet, there are needs that farmers must be imparted with training to improve their skills to utilize these sources.

Table 5. Comparison of extent of use and perceived average effectiveness of ICT tools.

ICTs devices/ tools	Extent of Use		Effectiveness	
	Mean±SD	Rank	Mean±SD	Rank
Mobile Phone	4.61±1.714	1	4.06±0.789	1
TV	3.30±1.761	2	3.96±.089	2
Radio/FM	2.61±1.688	3	3.96±0.941	2
Agri. Websites	2.44±0.720	4	3.64±1.232	3
Internet	2.12±1.206	5	3.52±1.405	4
Agri. Helplines	2.00±0.609	6	3.29±1.360	5
Computer	1.21±1.036	7	2.73±1.328	7
Land line phone	1.00±0.484	8	2.84±1.291	6

Scale: 1= V. Low 2= Low 3=Medium 4=High 5= V. High

***Conclusion*:** With the passage of time information needs of the farmers are increasing. Meeting these information needs is heavily reliant on accessibility of information on diversified sources, Farmers were using traditional and latest information sources to meet their information needs. However, Mobile, TV and radio were mostly used media to access information regarding different avenues of farming. Use of Mobile was higher than TV and Radio. Whereas, use of agri. websites, internet, helplines and computer appeared least. Being, accurate, broadcasting timely information, lesser cost, user friendly nature and easy access were the reasons behind extended use and effectiveness of mobile, TV and radio. To escalate the effectiveness of other ICT tools like computer, internet, agri. websites and helplines, there is need of user friendly interface and cost saving. Socio-economic conditions of the farmers' significantly impact their preference to choose information source. Less expensive, easy to use and delivering timely and accurate information usually attract farmers. Therefore, still traditional sources TV and Radio are perceived effective among farmers. This study recommends concerned departments such as agriculture information department to amend contents of modern tools according the needs and socio-economic conditions of the farmers.

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