Research Article

Farmers Perception of Agricultural Extension Services in Disseminating Climate Change Knowledge

Naveed Afsar* and Muhammad Idrees

Department of Agricultural Extension Education and Communication, The University of Agriculture, Peshawar, Khyber Pakhtunkhwa, Pakistan.

Abstract | No doubt, climate change is a severe issue and is affecting agriculture directly. Present research was done to know the farmers perceptions about agricultural extension services in disseminating climate change knowledge in Khyber Pakhtunkhwa. Data was collected from the 400 farmers of the two purposively sampled districts as these two were the highly vulnerable areas from climate change. The major source of climate change information of the majority of farmers was electronic media and the overall regression analysis of the climate change perceptions reveal that climate change is happening and long-term mean temperatures have been increased with a significant decrease in the long-term mean rainfall over the past decades. The study recommends that farmers should be trained well to more appropriately tackle the menace of climate change, extension workers should be made sure to visit the farmers in their fields on regular basis, and Government should promote information technology in order to properly disseminate the climate change knowledge.

Introduction

According to the Intergovernmental Panel on Climate Change (IPCC), the climate change means any transformation in climate over time whether it would be due to human activity or as a result of natural variability (IPCC, 2007). Day by day our atmosphere is getting warmer. Global warming is severely affecting our agriculture sector. The productivity of grains will be significantly affected due to climate change. The quantity and patterns of the precipitation is altered whereas climate change increase sea and land temperature. Droughts and floods like extreme events may occur frequently due to these impacts (Nema et al., 2012). The Carbon Dioxide (CO2) emissions of Pakistan are actually very low than the other Himalayan slope countries.

The climate change is a worldwide scenario but its effect is firstly felt on the local level (Abas et al., 2017). Agriculture sector is very essential for the financial system of Pakistan because all the raw materials to the industries are provided by this sector which ultimately alleviates poverty in country. The climatic conditions like the precipitation, temperature, floods and other aspects affect economic growth and the commodity prices directly (GoP, 2018). According to the Global Climate Risk Index, Pakistan is ranked the 8th most highly affected country due to climate change (Eckstein et al., 2018). The development of agricultural sector is dependent upon the sharing of reliable information. Agricultural extension mainly depends upon the information exchanged among farmers (Rehman et al., 2013). Agricultural Extension is an exceptionally essential entity and the new

knowledge cannot be disseminated to the farmers until and unless there is an availability of well trained, sophisticated and properly qualified Agriculture Extension Officers (AEOs) which have given this task to disseminate modern knowledge and technology to the end users (Khan et al., 2012). The Agri. extension department has a very considerable responsibility in context of climate change because they are creating awareness that what are the best adaptation practices that should be incorporated according to the local context. The climate change knowledge is needed to be dispersed among the farmers and they should be made capable of dealing with the harmful costs of climate change (Safdar et al., 2014).

Keeping in view the importance of climate change information in agriculture, the present study was designed to highlight the role of extension services in disseminating climate change knowledge perceived by the farmers in district Karak and Mansehra, Khyber Pakhtunkhwa.

Materials and Methods

Two districts of Khyber Pakhtunkhwa province namely Karak from southern piedmont plains zone and Mansehra from eastern mountainous zone were purposively selected for this study because these districts are fragile and severely affected from climate change in the past. Multistage sampling method was used to draw the required sample for the present study. Union council Chokara was chosen through simple random sampling. From U.C. Chokara, three villages (Chokara, Ghundi Kala and Babbal Khel) were randomly selected. From U.C. Labarkot, three villages (Labarkot, Kotkay and Kalgan) were randomly selected. The total numbers of farmers in District Karak were 34318 and 103698 in District Mansehra according to district office agricultural extension. Yamane formula was used to select sample size from the available population data. i.e.

$$n = \frac{N}{(1 + N_e 2)} \quad \dots Yamne$$

Now by equally distributing the sample size we study 32 farmer respondents from each village of Karak and 101 farmer respondents from each village of Mansehra thereby making a sample size of 400 respondents.

Data collection
Structured interview schedule was prepared to collect quantitative data. Personnel observation and key informant interviews were used to obtain qualitative data from the farmers.

Statistical analysis of data
Frequencies and percentages were calculated from quantitative data while Binary logit model was used to predict the perceptions of the farmers regarding climate change and will identify its important determinants.

$$Y_i = (\beta \times X_i) \quad \dots (1)$$

Perception ($Y_{i)} = f$ (Education, Age, Farm size, Farming experience, Tenancy status, Topography and extension visits).

$Y_i =$ is the perception of the i th farmer that climate is changing. Y= {1,0}; $X_i =$ the vector explanatory variables of probability of perceiving climate change by i th farmer; β= the vector of parameter estimates of the explanatory variable.

$$P_i = \frac{1}{1 + e^{(-z)}} \quad \dots (2)$$

Where:

$$Z_i = \log\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 X_{1i} + \dots \dots \beta_n X_{ni} + \varepsilon i \quad \dots (3)$$

Where;
P_i= Probability of i th farmer to perceive that climate change is happening; Z_i = is the logit value or the log of odd ratio P_i/1-P_i). Odd ratio is the probability of a farmer to perceive that climate change is happening to the probability that climate change is not happening.

Role of agricultural extension in building the adaptive capacity of farmers for successful adaptation to climate change was tested by using one-sample t-test to express perception regarding different attributes. One sample t-test uses the following formula:

$$t = \frac{\bar{X} - \mu}{S/\sqrt{n}} \quad \dots (4)$$

Which under the null hypothesis follow a t-distribution with (n-1) degrees of freedom. In Equation (2), X-μ are the sample and population means, respectively; S is the sample standard deviation and n is the sample size.

Results and Discussion

Farmers were asked regarding visit of agricultural extension workers. Data on this aspect is present in

Table 1. This table states that more than 70.8% of the selected respondents among all the selected villages were visited by the agricultural extension workers and only 29.3% were not visited by agricultural extension workers. Among the villages, the village Kotkay large number of farmers reported that they are visited by agricultural extension worker of their area. This does mean that the extension department do more active role in facilitating the local farmers and contact them on a regular basis. Results of the current study were found dissimilar to that of Ahmad et al. (2007) who stated that unfortunately the services of extension workers were not very impressive. Majority (85%) of the farmers was unaware of the services of the extension workers and almost 88% of the farmers did not get any benefit from extension workers.

Table 1: *Distribution of respondents by agricultural extension worker visit to farmers.*

District	Villages	Visit of Agricultural Extension Worker		Total
		No	Yes	
Mansehra	Labarkot	31 (30.7)	70(69.3)	101
	Kotkay	19(18.8)	82(81.2)	101
	Kalgan	33(32.7)	68(67.3)	101
Karak	Chokara	7(21.2)	26(78.8)	33
	Ghundi Kala	14(43.8)	18(56.3)	32
	Babbal Khel	13(40.6)	19(59.4)	32
Total		117(29.3)	283(70.8)	400

Source: *Field Data, 2018; (Figures in parenthesis are percentages).*

Results in Table 2 depicts that majority (80.3%) of the farmers said that they know climate change. Results regarding knowledge about climate change in case of Mansehra reveal that in village Labarkot of district Mansehra majority (65.3%) reported that they have heard about climate change, whereas 34.7% reported that they were not aware of climate change and the major source of climate change information was electronic (28) followed by print media (21), fellow farmers (9) and extension worker (8). No respondent reported that they get any information from any NGO regarding climate change. In village Kotkay of district Mansehra, majority (86.1%) respondents reported that they had knowledge about climate change and were aware of the changing climate while only (13.9%) reported that they had no knowledge about climate change. The major source of information regarding climate change was electronic media (32) followed by print media (26), fellow farmers (17) and extension

worker (12). In village Kalgan of district Mansehra, majority (85.1%) respondents reported that they had knowledge about climate change and were aware of the changing climate while only (14.9%) reported that they had no knowledge about climate change. The major source of information regarding climate change was electronic media (31) followed by print media (25), fellow farmers (19) and extension worker (11) as a source of climate change information.

In village Chokara of district Karak, majority (84.8%) respondents reported that they had knowledge about climate change and were aware of the changing climate while 15.2% reported that they had no knowledge about climate change. The major source of information regarding climate change was electronic media (10) followed by fellow farmers (8), print media (6) and extension worker only (4) as a source of climate change information. Interestingly, no respondent reported NGO as a source of climate change information. In village Ghundi Kala of district Karak, majority (78.1%) respondents reported that they had knowledge about climate change and were aware of the changing climate while (21.9%) reported that they had no knowledge about climate change. The major source of information regarding climate change was electronic media (11) followed by fellow farmers (6), print media (5) and extension worker only (3) as a source of climate change information. In village Babbal Khel of district Karak, majority (90.6%) respondents reported that they had knowledge about climate change and were aware of the changing climate while (9.4%) reported that they had no knowledge about climate change. The major source of information regarding climate change was electronic media (10) followed by fellow farmers (7), print media also (7) and extension worker only (5) as a source of climate change information.

Here only 43 out of 321 farmers called extension worker as a source of climate change information. It is an alarming situation for the department of agricultural extension and therefore, this office should deal the matter on urgent basis. There is also a dire need to keep update the farming community on climate change.

These results are almost similar with the results of Semenza et al., 2008 who revealed that about 98% farmers in Portland and 92% in Houston were aware about climate change and also huge numbers

Table 2: *Distribution of respondents regarding knowledge about climate change.*

District	Villages	Knowledge about "Climate Change"		If yes then Source of Information				
		No	Yes	Extension Worker	Electronic Media	Print Media	NGO	Fellow Farmers
Mansehra	Labarkot	35 (34.7)	66 (65.3)	8	28	21	0	9
	Kotkay	14 (13.9)	87 (86.1)	12	32	26	0	17
	Kalgan	15 (14.9)	86 (85.1)	11	31	25	0	19
Karak	Chokara	5(15.2)	28 (84.8)	4	10	6	0	8
	Ghundi Kala	7 (21.9)	25 (78.1)	3	11	5	0	6
	Babbal Khel	3 (9.4)	29 (90.6)	5	10	7	0	7
Total		79 (19.8)	321 (80.3)	43	122	90	0	66

Source: *Field survey 2018; (Values in parenthesis are percentages).*

of communities have reported levels of concern to changing climate.

Odd ratios are estimated through logit regression and are demonstrated in Table 3. The results illustrate that odds of education, farming experience, farm size and extension worker visit are greater than 1 which depicts that farmers with these attributes have more likely awareness about climate change and consistent with Tologbonse et al., 2010. The odd ratio of education depicts that educated farmers are more likely cognizant about climate change. This implies that educated farmers are 2.375 units more aware about climate change and it can be interpreted as holding other variables constant that if the education is increased by one year the logit in favor of perception of climate change will increase by 2.375 units and consistent with Deressa et al., 2009. The odd ratio of farming experience depicts that farmers with more years of experience are more likely cognizant about climate change and if farming experience is increased by one year it will increase the log of odd ratio, the logit in favor of climate change perception by 0.061 units and is consistent with the previous studies of Nhemachena and Hassan, 2007. The odd ratio of farm size depicts that farmers with more area of land are more likely cognizant about climate change and it further means that if farm size is increased by one acre it will increase the log of odd ratio, the logit in favor of climate change perception by 0.627 units. The odd ratio of extension worker visit depicts that those farmers who were regularly visited by the extension workers are more likely cognizant about climate change. This implies that farmers with extension visits are 0.530 units more aware about climate change. The odds of head's age, tenancy status and topography of the farm were less than 1 which reveals that these has less impact on climate change knowledge.

Table 3: *Regression analysis of factors influencing climate change knowledge.*

Variables	Coefficient	S.E.	Wald	P-value	Odd ratio
Age	-.723	.435	2.763	.096	0.485
Education	2.375	.381	38.929	.000	10.756
Farming experience	.061	.446	.019	.891	1.063
Farm size	.627	.230	7.459	.006	1.872
Tenancy Status	-.731	.186	15.481	.000	0.482
Topography	-.423	.281	2.266	.132	0.655
Extension Worker Visit	.530	.334	2.515	.113	1.699
Constant	1.766	.875	4.077	.043	5.850

Source: *Calculation by Author; Log likelihood: 272.886; Pseudo R²: 0.268.*

There were three main roles that were identified by farmers for agricultural extension that can build their capacity to climate change adaptation in the study area. Results in Table 4 depicts that majority (86.3%) respondents' perceived and were agreed to the statement "role of agricultural extension is to conduct awareness meetings with farmers to sensitize them on climate change management". The findings on conducting awareness meetings as a major role of agricultural extension support the reports by Magrath and Sukali (2009) and Mandleni and Anim (2011) who reported that awareness on information and knowledge on climate change management enable farmers to make informed choices on available climate change adaptation technologies. A majority (89.5%) of the respondents agreed that agricultural extension department can conduct demonstrations in order to train farmers on new knowledge and skills on climate change adaptation technologies. The results agree with other findings that demonstrations are very effective in transferring knowledge and skills that are necessary to implement the new

Table 4: *Farmers' perceptions regarding the role of agricultural extension in capacity building.*

The role of Agricultural Extension is to:	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree	t	Mean Difference	Significance
Conduct awareness meetings with farmers to sensitize them on climate change mgt.	19 (4.8)	345 (86.3)	2 (0.5)	34 (8.5)	0	-28.41	2.13	.000
Conduct demonstrations in order to train farmers on new knowledge and skills on climate change adaptation technologies.	40 (10.0)	358 (89.5)	2 (0.5)	0	0	-70.60	1.91	.000
Disseminate information on weather focus and early warnings to farmers for better planning.	42 (10.5)	356 (89.0)	2 (0.5)	0	0	-69.48	1.90	.000

Source: *Field Survey 2018 and Calculations by Author; (Values in parenthesis are percentages.*

agricultural technology (Okunade, 2007; Khan et al., 2009). Similarly, a majority, (89.0%) farmers suggested that there should be dissemination of the information on weather focus and early warnings to farmers for better planning. Ozor and Cynthia (2011) and Kalanda-Joshua et al. (2011) also reported that over reliance on rain-fed agricultural systems require accurate climate and weather forecasts to guide farmers to plan their farming systems. Such planning will reduce the negative effects of climate change.

Conclusions and Recommendations

Although, majority of the farmers were visited by the extension workers but in case of the services of extension workers, they were unaware and did not get any benefit. Mostly, the farmers were known to climate change. A major number of farmer's source of climate change information was electronic media, while a limited number of farmers called extension workers as a source of climate change. There were loopholes found in the performance of agricultural extension workers. A large number of farmers identified three main roles for agricultural extension workers; "conduct awareness meetings with farmers to sensitize them on climate change management", "conduct demonstrations in order to train farmers on new knowledge & skills on climate change adaptation technologies" and "disseminate information on weather focus and early warnings to farmers for better planning" that will build their capacity to climate change adaptation. This study further concludes that climate change knowledge and adaptation are highly influenced by socioeconomic factors (education, farming experience, farm size and tenancy status) and access to institutional services (agricultural extension). It is therefore, recommended that extension workers should not only be made sure to visit the farmers in their fields on regular

basis but inform them about the extension services. Special trainings should be arranged on a regular basis from the extension department to the farmers in order to make the farmers adaptive to the current climatic needs. Government should direct extension department and promote information technology in order to properly disseminate the climate change knowledge.

Novelty Statement

The present research sought farmers' perceptions about climate change knowledge and highlighted role of agricultural extension services to the farming community in Khyber Pakhtunkhwa. Climate Change is a severe issue, which is affecting agriculture production directly.

Author's Contribution

The present study was the part of PhD dissertation, the whole study was conducted under the supervision of the Prof. Dr. Muhammad Idrees. The study was designed by Prof. Dr. Muhammad Idrees whereas data collection, analysis and write-up were done by Naveed Afsar. Moreover, final revision before submission was also given by Prof. Dr. Muhammad Idrees.

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